Energy Element

City of Alameda

CITY OF ALAMEDA • CALIFORNIA

APRIL 20, 1981

CORRECTION

CITY OF ALAMEDA - ENERGY ELEMENT

THE TITLE OF FIGURE 1 ON PAGE 4 SHOULD BE:
"ELECTRICITY SUPPLY TO THE ALAMEDA BUREAU OF ELECTRICITY"

Energy Element

Prepared by the City of Alameda
Planning Department
adopted by the City Council
December 18, 1979

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Goals

The Goals of Alameda's Energy Conservation Program are as follows:

1. Reduce the City's dependence upon fossil fuel energy.
2. Increase the number of options available to the City for satisfying future energy needs, and for influencing the allocation and use of energy.
3. Provide timely responses to the City's energy needs which balance the City's physical, environmental, economic and socio-political considerations.

In keeping with these goals, the Energy Conservation Committee developed objectives. After a review of the technical and statistical characteristics of Alameda, the Committee decided on a set of recommended Energy Policies. During this process, the Committee considered the social, economic, cultural and historical qualities of Alameda that are often difficult to quantify. Environmental impacts, and alternatives were also considered. This analysis is summarized on Page 32, but environmental issues are discussed throughout the report.

Implementation

The City should establish a permanent Energy Committee, and an Office of Energy Conservation to implement these recommendations.

Transportation

The City's Combined Land Use Plan outlines a program for improving transportation within the City. Much of this program is directly concerned with energy conservation. Recognizing this fact, the City should give priority to carrying out those portions of the program most likely to promote energy conservation as recommended on Page 30.

Consumer Education

Recognizing that an Energy Conservation Program can be effective only through the efforts of an informed citizenry, the City will assist PG&E and the Bureau of Electricity in educating consumers on energy conservation practices.

Municipal Facilities

The City will set an example for all its citizens by promptly conducting energy audits of all municipal facilities. The City should actively seek State and Federal financial assistance in carrying out this and other parts of the conservation program.

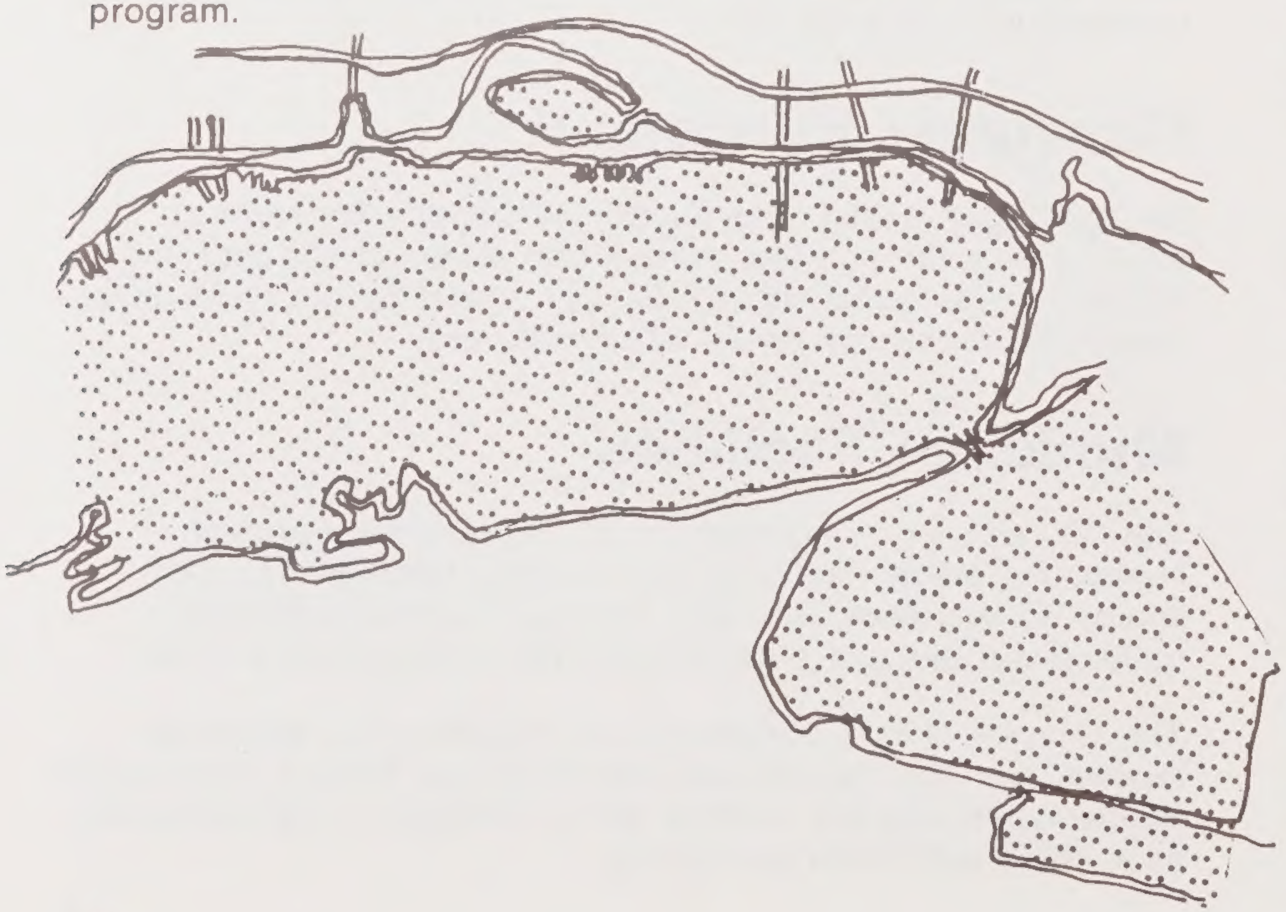
The City will ensure compliance on the part of all municipal facilities with the Federal and State limits on heating and cooling temperatures, and will monitor the compliance of the community as a whole with these regulations.

Preface

The elements of the General Plan provide the framework for the future character and quality of the development and ongoing function of the City. Alameda's General Plan currently encompasses the following elements: Land Use, Open Space, Circulation, Conservation (of Natural Resources), Airport Safety, Seismic Safety, Scenic Highways, Housing and Noise.

Now, in conjunction with a citizen's Energy Conservation Committee, and the State Energy Commission (which also provided part of the funding), the City's Planning Staff has prepared this Energy Element. It provides technical data and information on Alameda's energy use and supply, statements of the Committee's energy goals and objectives, and the methods available to the City to implement more efficient use of energy in Alameda.

The Energy Element, finally adopted by the City Council, contains some general statements on energy policy and also contains the framework for developing an implementation program.



Introduction

I. The Energy Problem

Energy policy, or lack of it, has traditionally been a function of State and National government, but Alameda now has the opportunity to determine its own energy policy, and to influence and direct those aspects of energy within its reach. This is part of Alameda's history, being the owner of the second oldest municipal electric utility in the United States, the Bureau of Electricity. This element will look at energy use in different sectors of the community and the roles played by the Bureau, general city government, Pacitic Gas & Electric, and the private sector. It will conclude with the methods available to increase Alameda's energy efficiency and self-sufficiency.

The present energy crisis derives from the gap between consumption and domestic production of energy, which traces its roots back three decades. Alameda, like the rest of the nation, has been affected by the energy crisis. During the decade of the 50's when energy prices were going down, and energy problems were unheard of, population increased and each of us used more energy, the latter factor contributing most to the growth. By the time 1960 arrived, the nation's energy use was at the rate of 21.5 million barrels of oil per day (MBPD) energy equivalent.

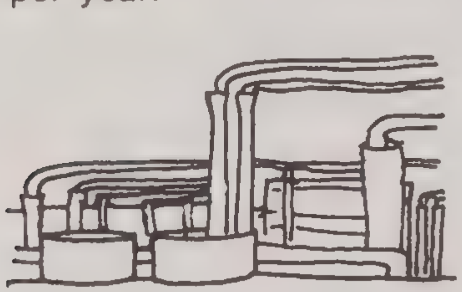
During the decade of the 60's, phenomenal energy growth continued. Energy use grew at the rate at over 4% annually resulting in use of 31.8 MBPD in 1970. Of particular note is that domestic oil production in the U.S. reached its peak that year. After 1970, domestic production started to decrease. Imported oil increased somewhat during the 1960's, and now significant portions are coming from the Middle East.

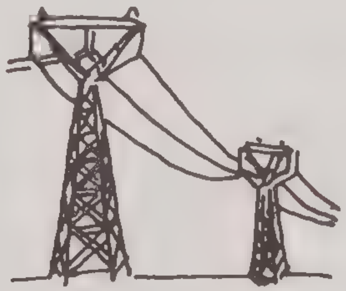
During the early part of the 70's, energy use grew at about 4.5% annually, so that by 1973, the year of the OPEC (Organization of Petroleum Exporting Countries), oil embargo, our energy use was 36.6 MBPD.

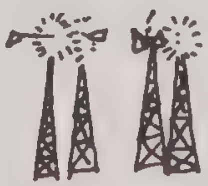
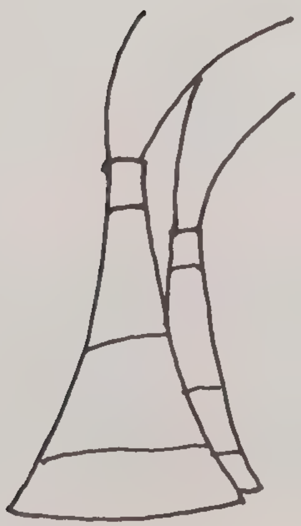
As a result of the oil embargo, the quadrupling of the price of that oil, and the subsequent rise in the price of domestic oil, natural gas, coal and the electricity produced from them, 1974

was the first year our energy use decreased significantly since the depression. Usage dropped 4% to 35.5 MBPD in 1974, and 3% in 1975 to 34.5 MBPD. The shock of higher prices had precipitated an economic recession and the beginnings of energy conservation efforts, but in 1977, energy use grew by over 5% again to 37.8 MBPD.

Production of oil from the lower 48 states had dropped to 9.0 MBPD when oil from the Alaska pipeline began to flow in September 1977. The pipeline, eventually capable of over 1.5 MBPD flow is, 1979, pumping nearly 1.0 MBPD. On the other hand, natural gas production has declined since 1973. Nuclear power production is currently becoming equivalent to that of hydroelectric power. The 60 U.S. nuclear power plants operating at 65% of design capacity, produce the equivalent of 1.2 MBPD per year.





The following Table 1 illustrates energy use in the United States from 1950 through 1977.

TABLE 1

ENERGY USE IN THE UNITED STATES: 1950-1977 (MILLION BARRELS PER OIL PER DAY ENERGY EQUIVALENT)*

	1950 (MBPD)	1960 (MBPD)	1970 (MBPD)	1977 (MBPD)
Domestic Oil:	8.0	10.5	10.2	
Lower 48 Oil:				9.0
Alaskan Oil:				0.3
Imported Oil	1.8	3.5	6.8	8.8
Gas*	6.0	10.5	11.2	10.0
Coal	5.0	6.0	6.5	7.0
Hydro electric	.7	1.2	1.4	1.5
Nuclear	--	0.1	.4	1.2
Total	**21.5**	**31.8**	**36.3**	**37.8**

Source: *Energy in Focus: Basic Data,* Federal Energy Administration May, 1977, FEA 1A-77/144

Source: *Exploring Energy Choices,* Ford Foundation Energy Policy Project, Washington, D.C., 1974.

* Includes both domestic and imported natural gas. There is no data on the proportion of imported gas.

II. Energy Supply for the City of Alameda

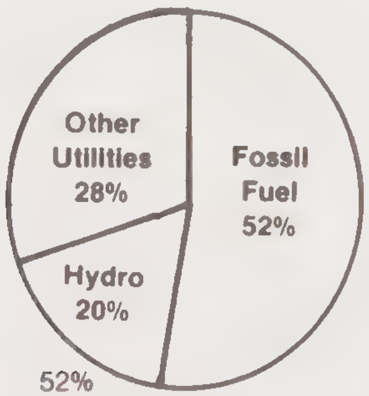
This section of the report deals with an examination of the overall energy supplies to the City of Alameda.

1. Sources of Electrical Generation

The City's own Bureau of Electricity distributes the electricity it purchases from PG&E.* Electric energy supplies within PG&E's entire service area are primarily generated from a combination of hydroelectric facilities, fossil fuel burning facilities, and purchased power from other utilities. PG&E's hydroelectric generation normally accounts for one-fifth of its delivered electric energy, about half of the remaining power is generated from fossil fuel plants, and the balance of electric power is purchased from other utilities. (See Figure 1).

Figure 1.

Electricity Supply to Alameda Pacific Gas & Electricity



SOURCES:	
Fossil Fuel	52%
Hydro	20%
Other Utilities	28%
PRODUCER:	
PG&E	100%
DISTRIBUTOR:	
PG&E	100%

RETAILER:	
Bureau	100%
CONSUMER:*	
Residential	47%
Commercial	28%
Industrial	24%

*Does not add up to 100% due to rounding.

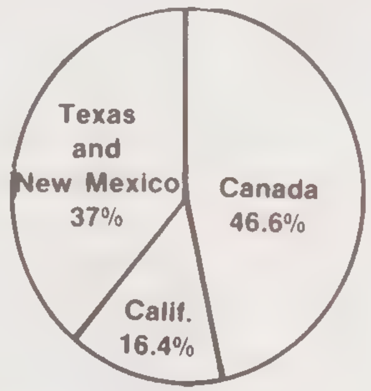
Electric and Natural Gas information derived from Pacific Gas and Electric Company's 1977 Annual Report.

2. Sources of Natural Gas

PG&E's natural gas energy supplies are received from sources in California, other states and Canada. Approximately half of the company's total supply is purchased from Canada; one-third is out-of-state gas, and the remaining amount is purchased from various California producers. (See Figure 2).

Figure 2.

Gas Supply to Alameda



PRODUCING AREAS:	
California	16.4%
Canada	46.6%
Texas & New Mexico	37.0%
PIPE LINE COMPANIES:	
Pacific Gas Transmission	63%
El Paso Transmission	37%
GAS RETAILER:	
PG&E	100%
GAS CUSTOMERS:	
Residential	42%
Commercial	27%
Industrial	31%

PG&E in recent years has been forced to curtail gas service to low priority industrial customers during certain periods. Reduced gas availability was attributed to curtailments in deliveries from out-of-state producers, and the declining deliverability of existing wells in California.

3. *Sources of Liquid Fuel*

The majority of liquid fuels that are consumed in Alameda are petroleum products, and are primarily used in the transportation sector. The liquid fuel supply for the City of Alameda, as well as the State of California, was estimated from data from the U.S. Bureau of Mines. The Bureau of Mines tabulates data on the inputs to refineries by month and by state. The inputs to refineries are also broken down by type of fuel sources —(crude oil, natural gas liquids, unfinished oils, etc.), and by origin (foreign, domestic, state of origin). (See Table 2).

TABLE 2

Estimated Sources of Petroleum

PRODUCTS SUPPLY FOR THE STATE OF CALIFORNIA - 1977

ORIGIN OF SUPPLY		PERCENT
California Crude		51.0
Other U.S. Crude		4.8
FOREIGN CRUDE		
Indonesia	15.0	
Iran	3.5	
Latin America	2.1	39.0
Arab Oil Embargo Nations	13.3	
Other	5.1	
Foreign Refined Products		4.1
Other U.S. Refined Products		.8
		100.0%*

N.B. Liquid fuel supply for the western states in which Alameda lies, is based on the above estimate.

* Does not add up to 100% due to rounding.

Source: *Petroleum Monthly*, January 1977 through December 1977, U.S. Bureau of Mines.

Source: *Petroleum Refineries in the United States and Puerto Rico* January through December 1977, U.S. Bureau of Mines.

Statistics are available on net refined products that went in or out of state and where they went. Study of these data makes it possible to estimate the make-up of petroleum supply to the community of Alameda.

It is estimated from Table 2, Estimated Sources of Petroleum, that Alameda receives 51% of these petroleum products from California sources, 44% from foreign sources, and the remaining 5% from other states. It is evident that Alameda is heavily dependent upon foreign petroleum sources.

III. Energy Demand for the City of Alameda

Section III of the Energy Element examines present energy demand in Alameda.

1. *Demand in the Stationary Sector*

The stationary sector includes those energy users which use energy at a fixed location. They comprise residential commercial and industrial users. (Note: The Naval Air Station (NAS) was not included as an energy user in Alameda because the City has no regulatory authority over NAS. NAS is conducting its own energy conservation program independently of the City of Alameda). 90% of Bureau of Electricity customers are residential, but they use only 47% of KWH billed.

The commercial sector in Alameda uses about 17% of the total energy consumed in the City. The commercial sector includes: finance, real estate, communication and utility businesses, Standard Industrial Classification (SIC 48 through 67); retail stores and wholesale outlets (SIC through 59), and other commercial businesses (SIC 70 through 89).*

19% of the total energy used in the City is consumed by the industrial sector. It is estimated that approximately 10% of the customers of the Bureau of Electricity are in the commercial and industrial sectors, and these users account for approximately 53% of the load. In Alameda, the industrial sector consists of the following industries: construction, (SIC 15, 16, 17), food and

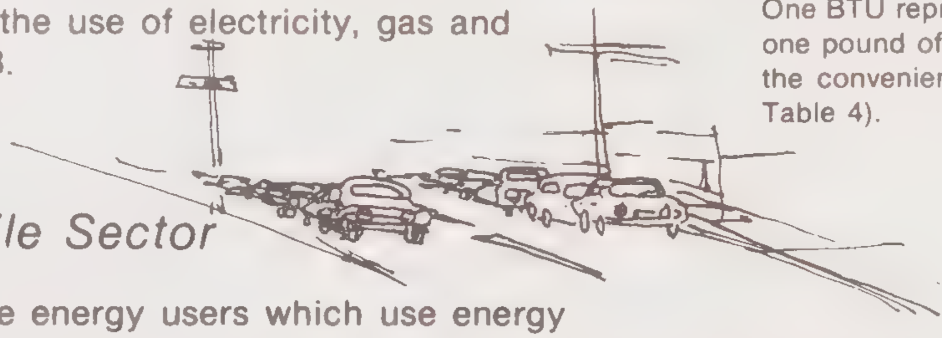
* *Standard Industrial Classification Manual*, Executive Office of the President, Office of Management and Budget, GPO, Wash. D.C. 1972.

kindred products (SIC 20), primary metal industries (SIC 33), transportation equipment (SIC 37), motor freight transportation (SIC 42), and other manufacturing (SIC 39, 40, 43, 47).

The large majority of energy used by Alameda's stationary sector is supplied by the gas and electric utilities. Community wide energy consumption data was provided by PG&E and the City's Bureau of Electricity for a one-year period.

PG&E distributes natural gas to the Alameda community, and classifies the community's gas consumption by residential and by Standard Industrial Classification (SIC) for non residential uses.

Because PG&E and the Bureau of Electricity classify their energy customers differently, total energy use (gas and electric) within the Alameda community, can only be analyzed from a residential and nonresidential basis. Table 4, expressed in British Thermal Units (BTU), displays by sector the use of electricity, gas and also liquid fuel during 1977-1978.



2. *Demand in the Mobile Sector*

The mobile sector includes those energy users which use energy for the purpose of transportation. Presently, there are no available statistics on actual gasoline consumption for the City of Alameda. However, it is possible to estimate gasoline consumption within the City of Alameda by the following method:

The State Board of Equalization provides data on the motor vehicle fuel use tax and total sales on gasoline. The Board of Equalization also breaks sales taxes down by city and county, including the City of Alameda. It is thus possible to use these data to arrive at a valid estimate of consumption in the community of Alameda using tax data. The total sales assessed at service stations in Alameda can be divided by the State Board of Equalization's statistics on cost per gallon for a given year.

If we are to use this method to calculate the total amount of gasoline consumed in the City, it is necessary to assume that there is a close relationship between gallons sold in the community, and gallons consumed in the community. The gasoline consumption for the City is presented in Table 3.

TABLE 3
LIQUID FUEL CONSUMPTION IN THE CITY OF ALAMEDA - 1977-1978

Total Estimated:	
Gallons of Gasoline Sold (Retail)	19,524,000
Gallons of Gasoline (City Government)	127,000
Gallons of Diesel (Retail)	2,870,000
Total Gallons of Fuel	22,521,000
Total Amount of Energy-Gasoline	2,338 billion BTU's
Total Amount of Energy-Diesel	390 billion BTU's
Total Amount of Energy-Gasoline and Diesel	2,728 billion BTU's

Note: Throughout this report, energy is expressed in British Thermal Units (BTU). One BTU represents the quantity of heat required to raise the temperature of one pound of water 1° F. The following energy conversions are provided for the convenience of the reader (See Energy Conversion Equivalents below Table 4).

Source: Taxable sales in California, Quarterly Reports 1977-78, State Board of Equalization.

TABLE 4

ANNUAL STATIONARY AND MOBILE CONSUMPTION* CITY OF ALAMEDA (Billion BTU)

	Gas**	Electric***	Liquid Fuel	Total	Percentage
Residential	1,622	351	-	1,973	27%
Commercial	1,070	209	-	1,279	17%
Industrial	1,219	179	-	1,398	19%
Transportation	-	-	2,728	2,728	37%
Total	**3,891**	**739**	**2,728**	**7,378**	**100%**

Common Units	BTU Equivalent
Cubic foot of natural gas	1,000
Kilowatt hours of electricity	3,400
Gallon of regular gasoline	119,000
Gallon of diesel fuel	136,000

* Excludes Alameda Naval Air Station. However, NAS' energy consumption is 319 billion BTU's for electric; 1,071 billion BTU's for natural gas - yearly use.

** Derived from data provided by Bureau of Electricity

*** Derived from data provided by PG&E

IV. Characteristics of Alameda's Energy Use

More specific energy use can be determined by surveying or auditing individual buildings. This is accomplished by reviewing the yearly energy use of a household or business and making a physical and statistical analysis of how gas and electricity in that building is used. PG&E presently provides such a service free to its customers. The Bureau of Electricity will soon be providing this service in conjunction with the Northern California Power Association.

1. Average Energy Use

Figure 3 shows average residential and commercial natural gas use per household over an 18-month period. Figure 4 shows average residential electrical use. For purposes of comparison, the average KWH for all PG&E customers in Northern California for electricity in March 1979, was 569 KWH ($19.50). For gas, it was 108 therms (21.39).*

Information about the levels of energy use of different housing types was based on a selected sample of Alameda homes, and was provided by the Bureau of Electricity and PG&E. Figure 5 illustrates the average therms for different housing styles, while Figure 6 illustrates the average KWH for different housing styles.

2. Energy Costs

It is also possible to estimate the range of future energy bills on a houshold basis. First, the factors influencing present energy bills should be reviewed. An electricity bill is determined by multiplying the number of KWH's used, by the cost per KWH. The Bureau of Electricity uses the PG&E "lifeline rate" which includes a service charge and a minimum 240 KWH allowance for all residential customers billed at the lifeline rate. All KWH's over the 240 minimum are billed at the nonlifetime rate. A Fuel Cost Adjustment Charge to cover the additional cost of fossil fuel that PG&E must purchase to supply power, is also determined on the 240 KWH lifeline rate and nonlifeline rate.

*California State Energy Commission, *Energy Watch*, Vol 2, #3, June 19, 1979.

Figure 3 AVERAGE THERMS PER RESIDENTIAL AND COMMERCIAL BILL

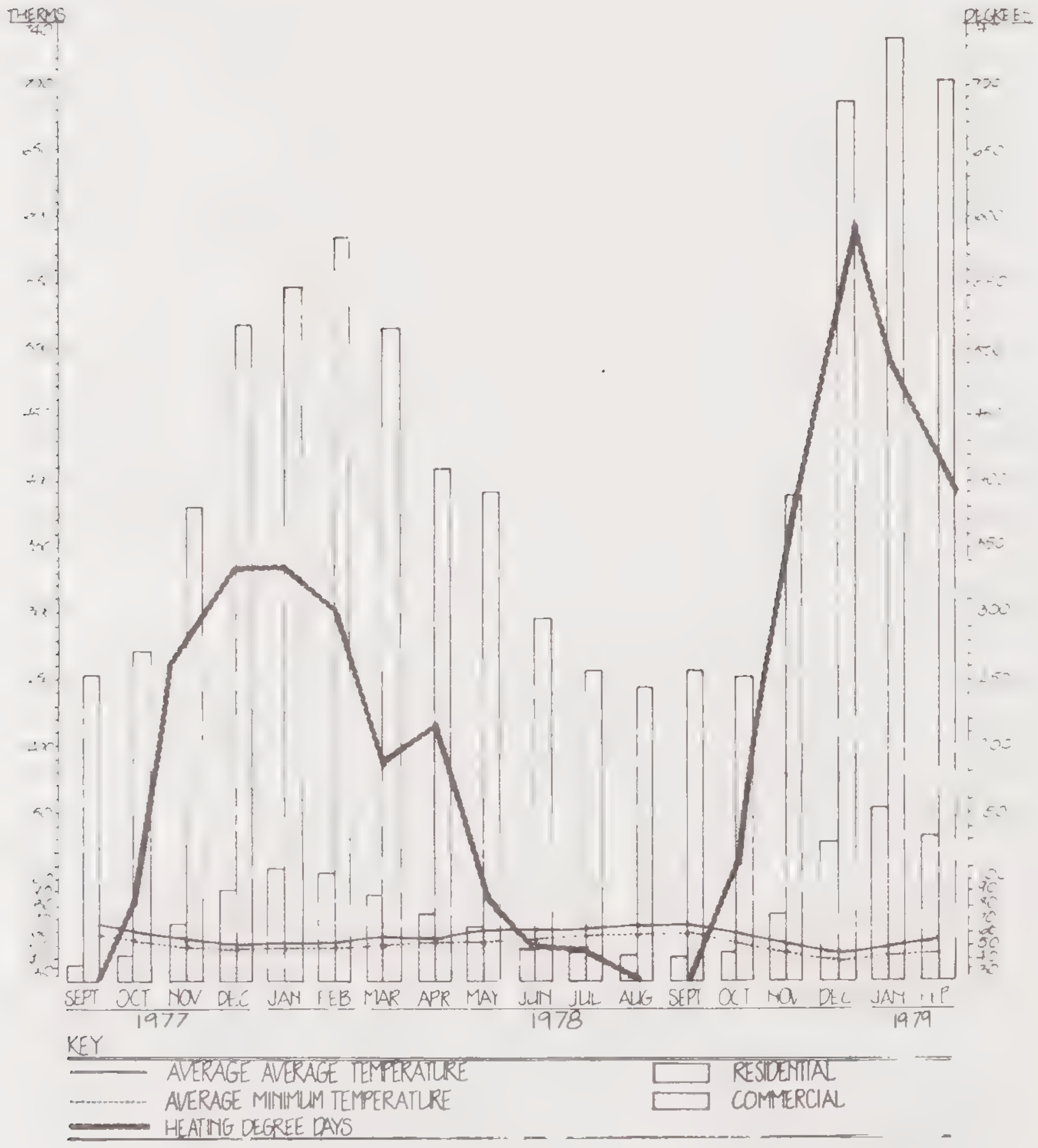
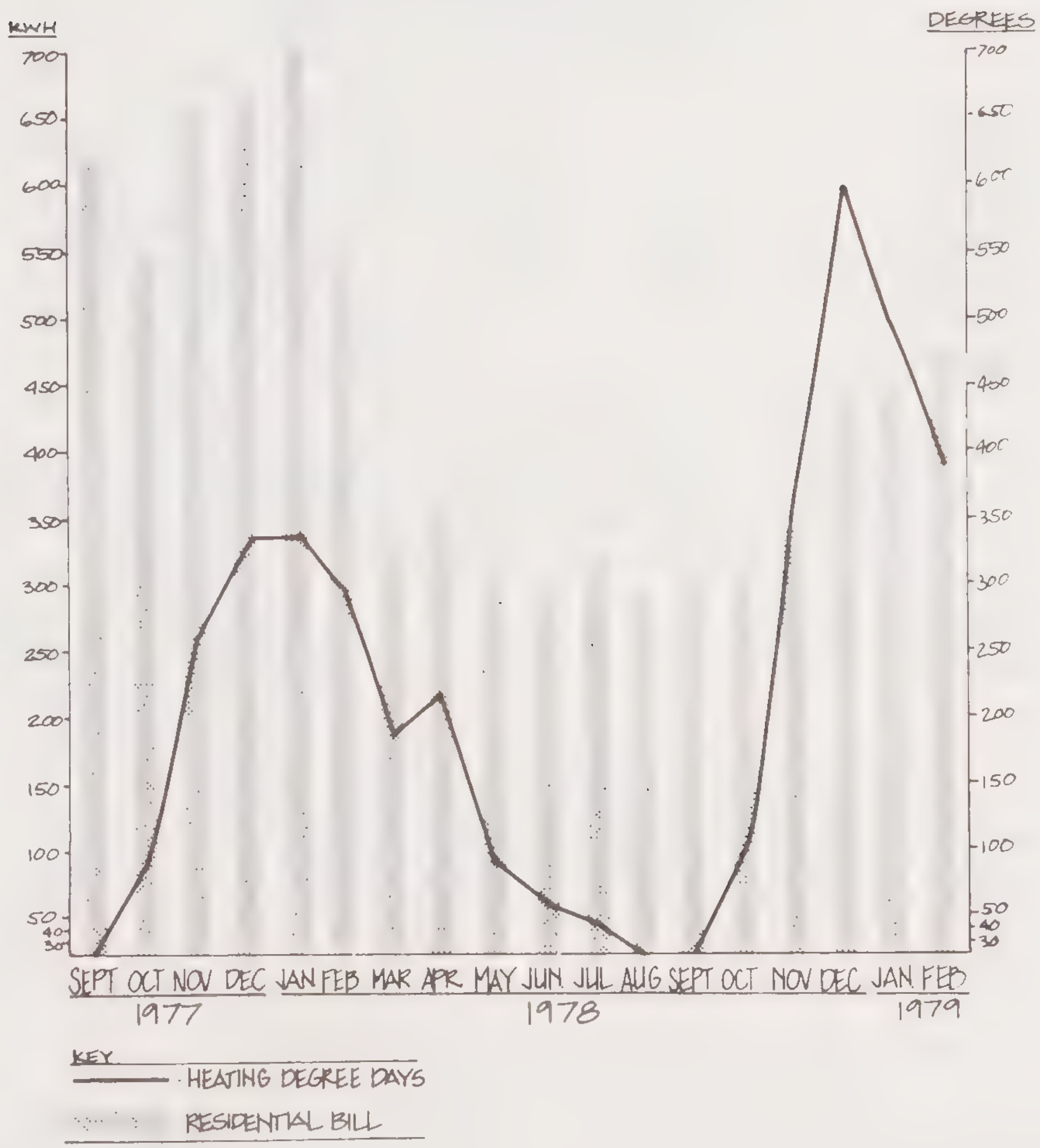


Figure 4 AVERAGE KWH PER RESIDENTIAL BILL



Source: Alameda Planning Department: Data provided by Bu/Elec. and National Oceanic/Atmospheric Administration.

Additional allowances are provided for electric water heating, electric heat in the heating season, and for life support systems. The service charge, energy charge and fuel cost adjustment charge are totaled, and a 5% City Utility Tax is added plus a State Surcharge of .00015 multiplied by the amount of the kilowatt hours used.

With OPEC increasing costs of crude oil, future prices for electricity will increase. The amount of the increase per KWH will depend on how much power can be obtained from cheaper sources such as hydro (less hydro power is available in dry years), and further increases in the cost of foreign oil. The combination of a dry year and large increases in the cost of fossil fuel could double the average electricity bill over only a one-year period. Table 5 shows the comparison of residential energy use over a 10-year period. Because the fuel cost adjustment has only been in effect since 1973, and varies due to price fluctuations, an average KWH charge is used for determining possible future costs.

TABLE 5

A COMPARISON OF KWH ANNUAL CHARGES AND USES FOR RESIDENCES IN ALAMEDA 1969-1979

	Average KWH Charge Per Year per residence	Residential Average Annual KWH Per Bill per residence
1969 . . .	.020	3873
1970 . . .	.020	3825
1971 . . .	.020	4312
1972 . . .	.0198	4395
1973 . . .	.0201	4444
1974 . . .	.0238	4438
1975 . . .	.0204	4462
1976 . . .	.0351	4296
1977 . . .	.0406	4195
1978 . . .	.0456	4160
1979 . . .	.0371	4328

Source: Alameda Planning Department: Derived from data provided by the Bureau of Electricity.

Average yearly useage of KWH per customer dropped from 4444 in 1973 to 4160 in 1978 but swung back up to 4328 in fiscal 1979. The average KWH's used per customer per year from 1969 to 1979 is 4278 KWH per year. The average charge per KWH is .0283.

Since natural gas rates are determined differently, an average of 1977 and 1978 residential bills was used as a base.

The U.S. Department of Energy assumes a doubling of energy prices will occur in the next 10 or 12 years. In the past four years, the Consumer Price Index has risen an average of 7.5% each year. Understanding these two assumptions is critical to understanding these estimates of future energy bills. Inflation could be higher, and the Fuel Cost Adjustment could double in a much shorter period of time. An illustration of a possible future energy bill for an average Alameda household can be made with two assumptions: (A) 7.5% inflation and a doubling of basic energy costs over the next 10 years (about 18% annual increase); and (B) 10% inflation and a doubling of basic energy costs every 5 years (about 24% annual increase).

Table 6

A Comparison of Estimated Annual Future Natural Gas and Electricity Costs Per Residence

	Assumption A	Assumption B
1978-1979 Base*	$285.00	$ 285.00
1984	459.00	717.00
1989	612.00	2,102.00

Assumption A: 18% yearly increase in natural gas and electricity costs.

Assumption B: 24% yearly increase in natural gas and electricity costs.

*Assumes today's usage.

Source: Alameda Planning Department. Derived from data provided by the Bureau of Electricity.

If it is assumed that the average Alameda household uses 840* gallons of gasoline for vehicle travel a year, and assuming today's average price of about $1.00 per gallon, then future costs could escalate as follows:

Table 7

A Comparison of Estimated Annual Future Gasoline Costs per Private Vehicle

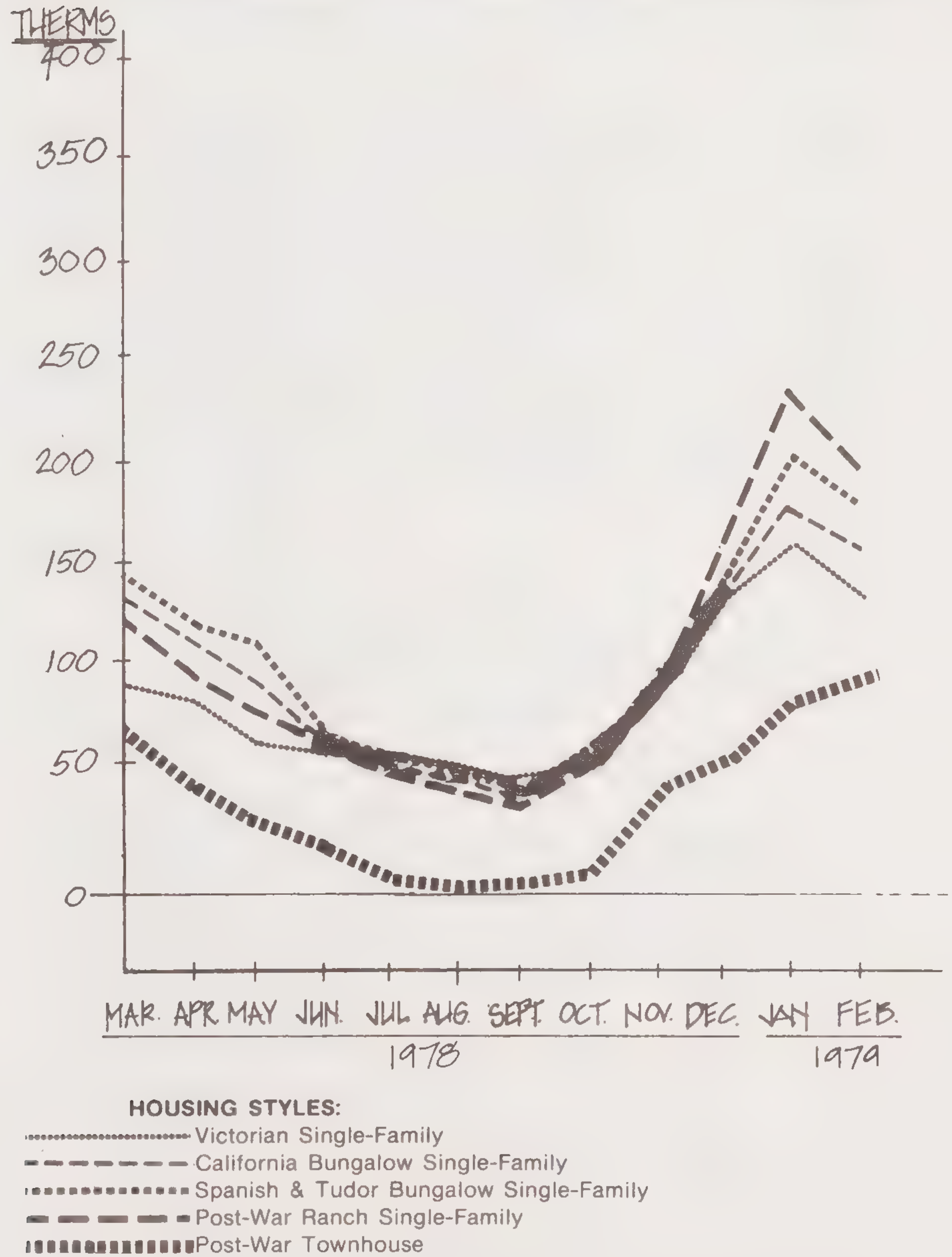
	Assumption A	Assumption B
1979	$ 840.00	$ 840.00
1984	1,921.72	2,461.86

Assumption A: 18% yearly increase in gasoline prices.

Assumption B: 24% yearly increase in gasoline prices.

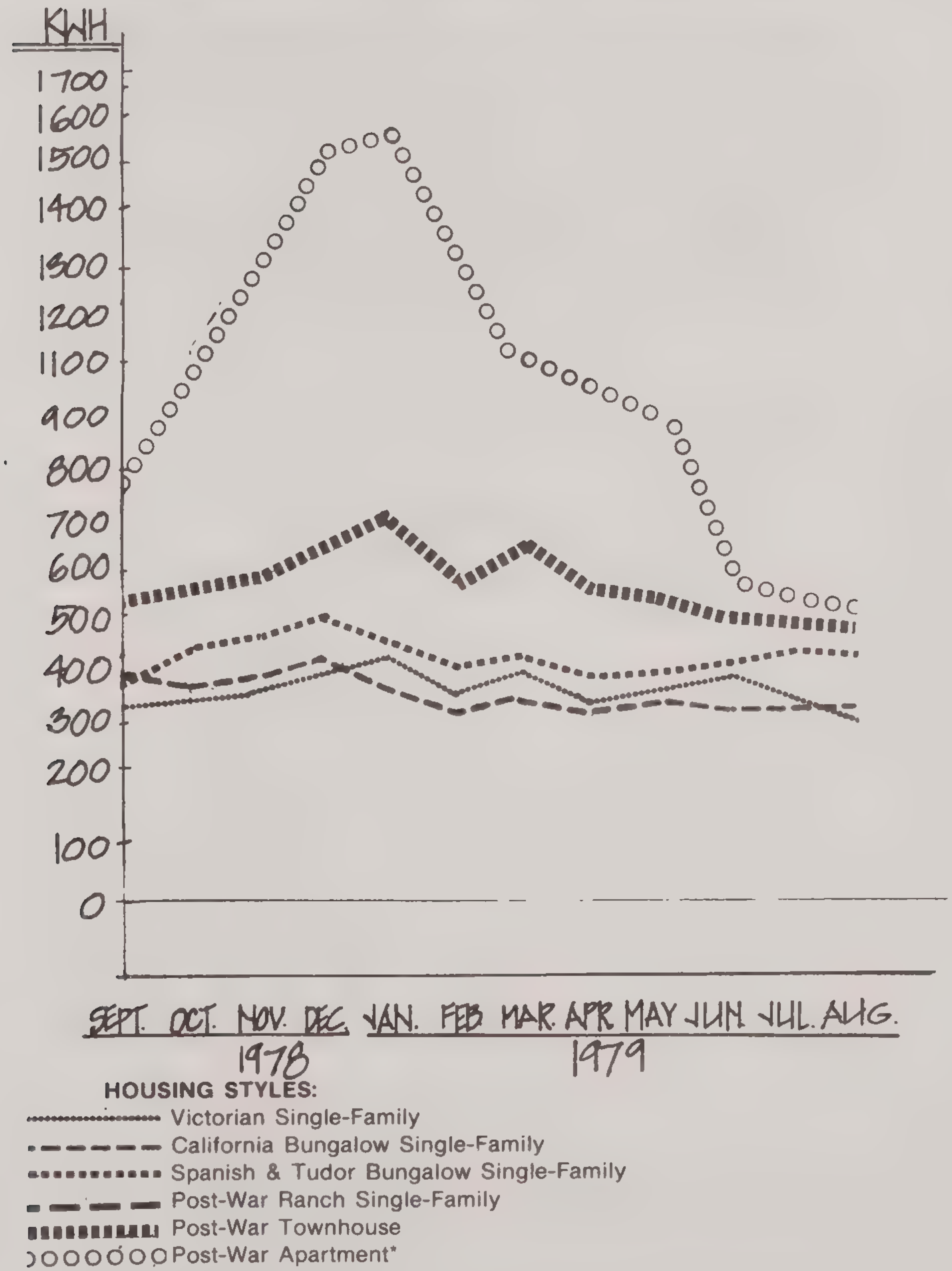
Source: Regional Transportation Energy Conservation Data Book, U.S. Department of Commerce, 1976. 12,600 miles per year - 15 MPG (Derived from the above mentioned source).

Figure 5 **AVERAGE THERMS PER MONTH FOR DIFFERENT HOUSING STYLES IN ALAMEDA**



Source: Alameda Planning Department: Data provided by PG&E.

FIGURE 6 AVERAGE KWH PER MONTH FOR DIFFERENT HOUSING STYLES IN ALAMEDA



*All electric
Source: Alameda Planning Department: Data provided by BU/Elec.

3. Climate and Energy Use

Alameda's monthly energy use from September 1977 to February 1978 was compared to changes in climate for the same period. Climate information is represented by "degree days", which is the differences in temperature between the Mean temperature of each day of the month and 65° Fahrenheit. Heating degree days are those which fall below 65° F., and cooling degree days are those which fall above 65° F. This is illustrated in Figure 3.

The primary conclusions that can be drawn from these charts are:

Electrical use in both the residential and non-residential sectors is fairly even throughout the year, pointing to the fact that electrical energy in Alameda is not extensively used for space conditioning (heating and cooling), but rather primarily for operating equipment, appliances and lighting.

Natural gas use in both the residential and non-residential sectors corresponds fairly closely to changes in climate, pointing to the fact that gas energy is primarily used for space heating. Also, there is a certain base demand for natural gas throughout the year for purposes other than space heating, namely, water heating, pilot lights and cooking in the residential sector. However, there are heating degree days throughout the summer months, reaching the lowest point in August and September. Space heating, then, may be needed in Alameda homes throughout the year with the possible exception of August and September. The significance of this is that it may only be practical to turn off a furnace pilot light during August and September. However, Figure 3 shows some inconsistent patterns of natural gas use during the weather transition periods in fall and spring. For instance, there were significantly more heating degree days in November 1977 than in March 1978. But natural gas use in March was higher for both residential and commercial customers, as compared to November. This could indicate a delay in response time to temperature changes. People may not be checking their thermostats when the weather warms up in spring. This indicates that a seasonal education campaign may be appropriate. It is also useful in reviewing energy use data.

4. Climate and Altèrnative Energy Sources

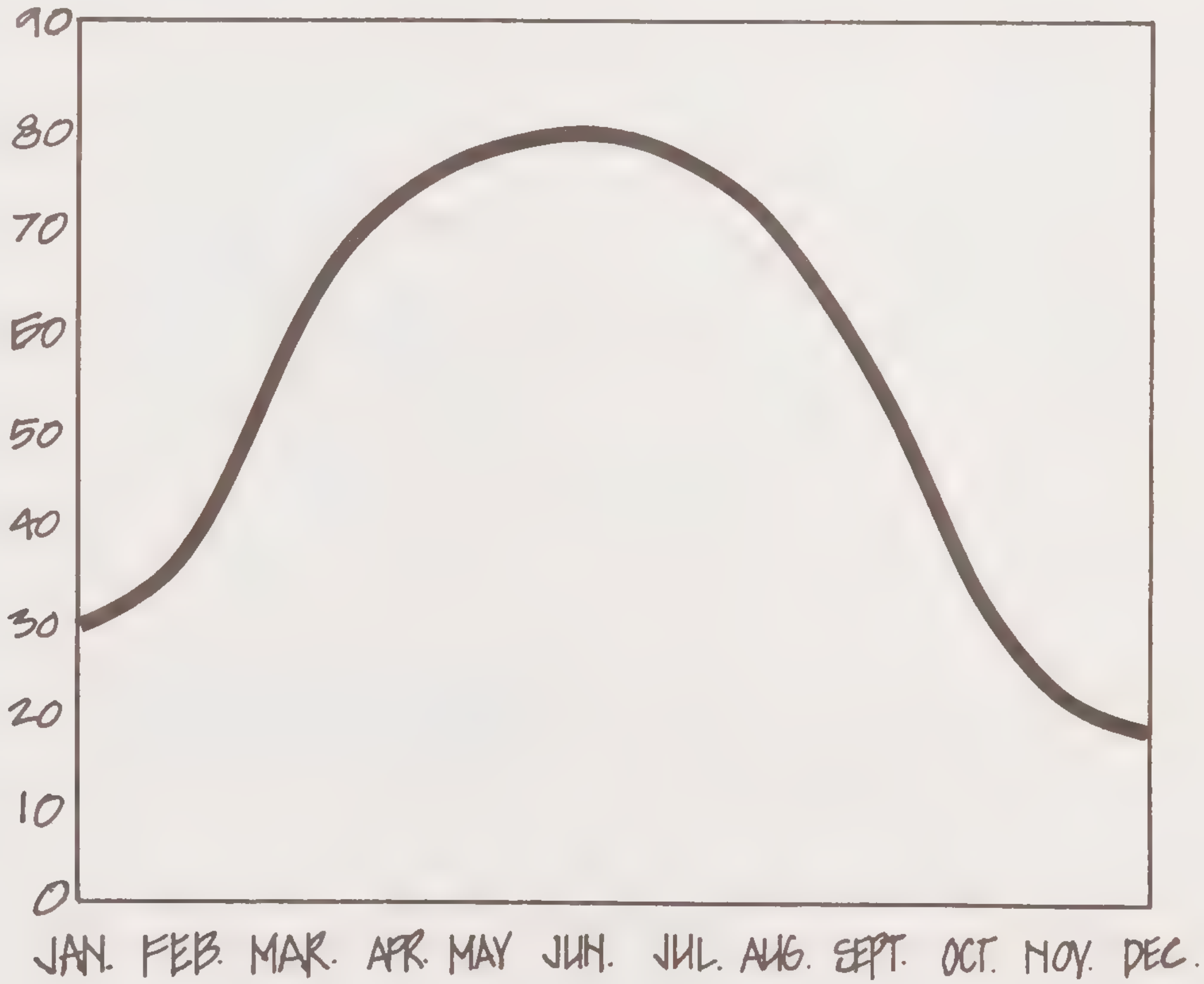
Climate is a primary factor in shaping the utilization of solar and wind energies on the local level. In this section of the report, a discussion of climate and alternative sources of energy will be examined.

a. Solar Insolation

The annual pattern of insolation (solar radiation) for the Oakland Airport is shown in Figure 7. This figure indicates that the total amount of solar energy falling at the Oakland Airport is about 1500 BTU per square foot per day. This translates into a monthly average of approximately 48,000 BTU's per square foot per month. Thus, there is sufficient solar radiation for the effective use of solar systems in Alameda.

FIGURE 7

SOLAR ENERGY ON HORIZONTAL SURFACE THOUSAND BTU/SQUARE FEET: 1977



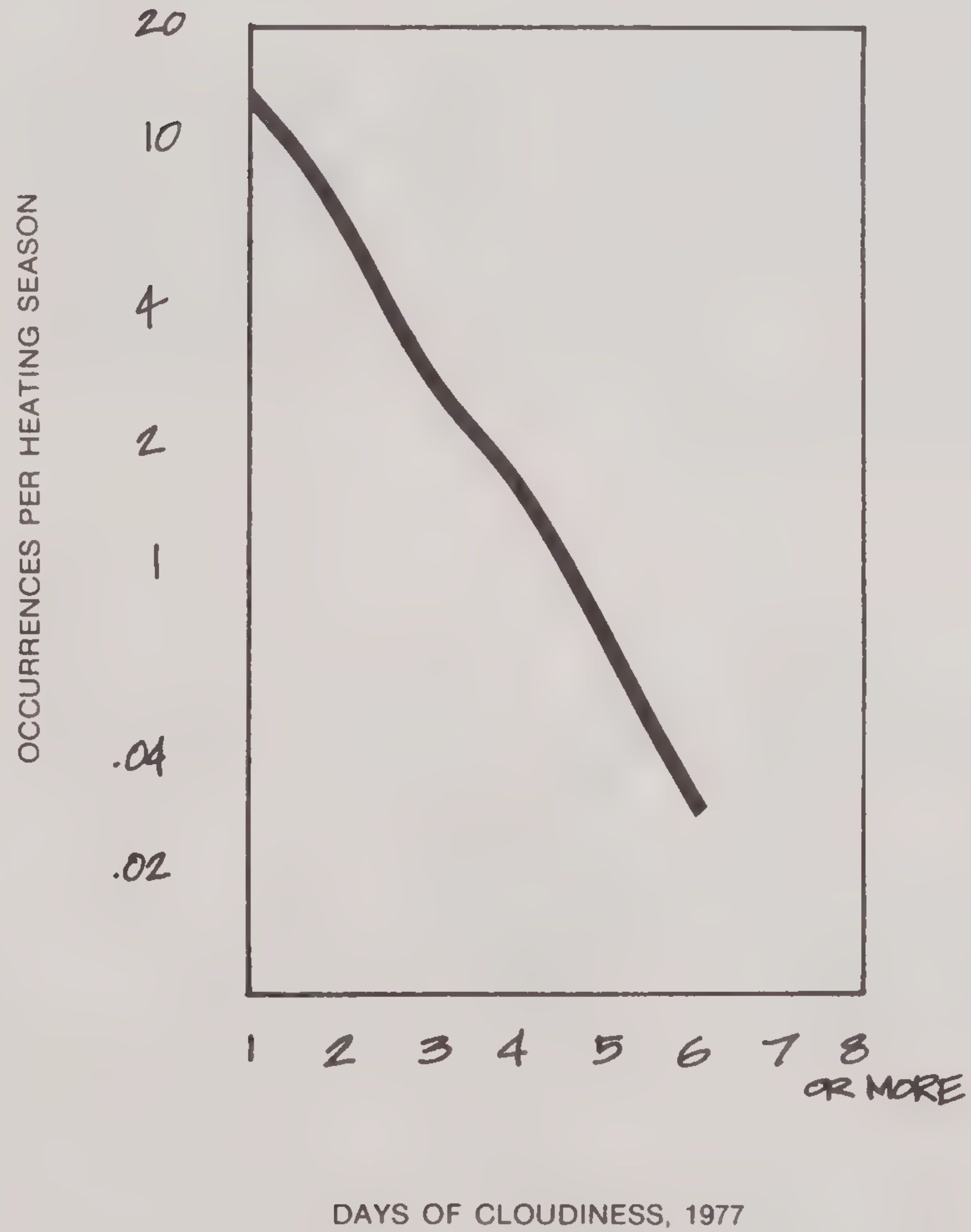
Source: National Oceanic/Atmospheric Administration, Environmental Data and Information Service, National Climate Center, Asheville, N.C.

b. Cloud Cover

The requirements for storage of back-up energy sources for solar systems are dependent upon the reliability of the solar energy source. In figure 8, the average number of occurrences per heating season (October-March) of cloudy periods of various durations are presented. This Figure indicates that the frequency of occurrence of single days of cloudiness in Alameda is about 15 times per heating season, while periods of five successive days of cloudiness occur only once during a heating season. It is thus apparent through the study of these data, that solar systems in Alameda would require back-up energy sources to operate properly during cloudy periods.

FIGURE 8

OCCURRENCE OF PERIODS OF CLOUDINESS - 1977



Source: National Oceanic/Atmospheric Administration, Environmental Data and Information Service, National Climate Center, Asheville, N.C.

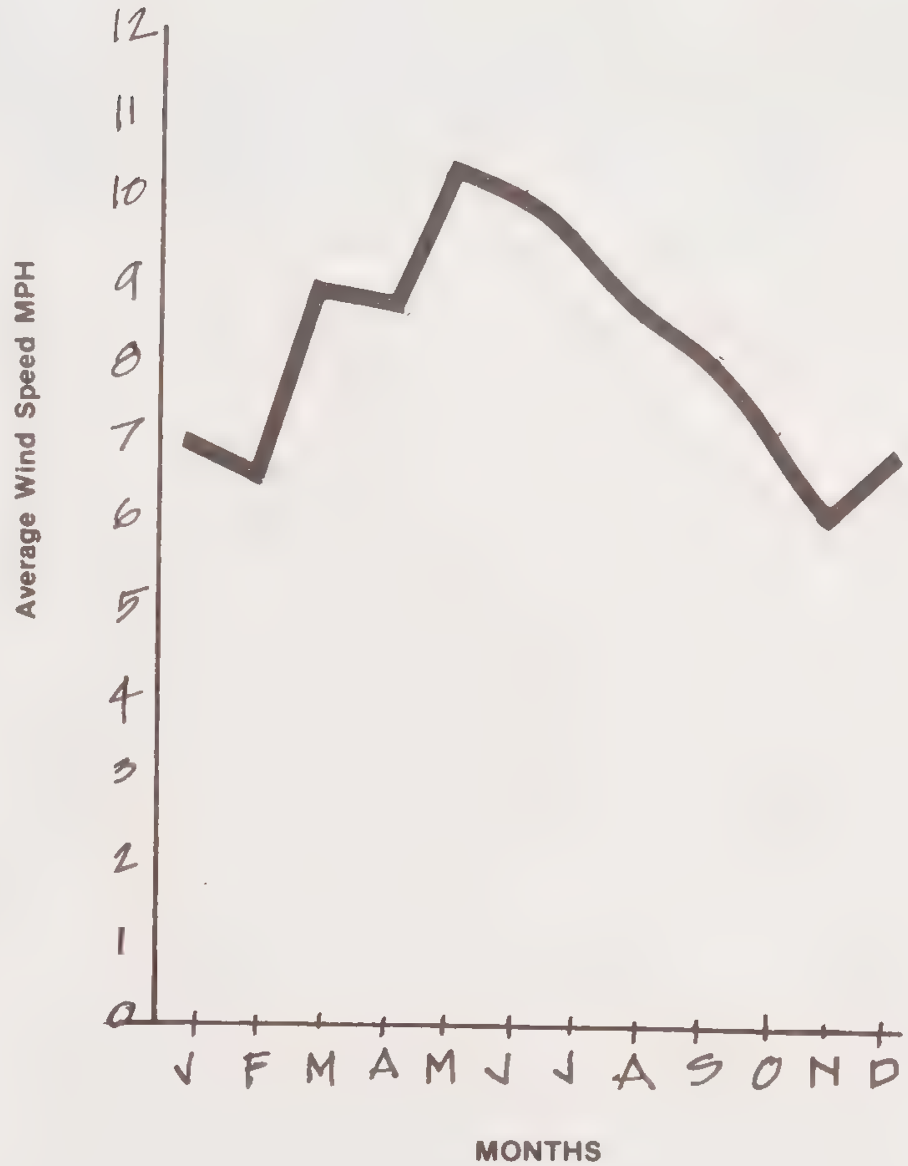
c. Wind

Conditions in Alameda for the use of wind power are considered not adequate for operating most wind generators. Specifically, the winds in Alameda are not consistent or predictable and thus, wind systems can only operate at full design capacity only a fraction of the time.

Alameda's annual average wind speed is about 8.3 MPH (1977), although during certain periods of the year, average wind speeds do exceed 11 MPH. The State Energy Commission has recently studied wind potential in California, and has assessed areas having Mean annual wind speeds of less than 12 MPH as "poor"; those areas with wind speeds between 12-14 MPH as "marginal": and those over 14 MPH as "good." Figure 9 provides statistical evidence to support the fact that wind power, as a major source of energy, is inappropriate in Alameda.

FIGURE 9

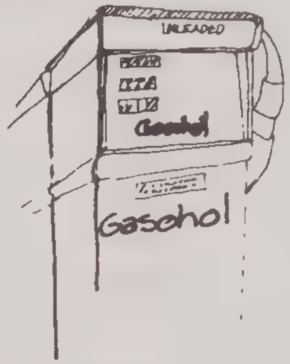
AVERAGE MONTHLY WINDSPEED AT THE OAKLAND AIRPORT (1977)



Source: National Ocean/Atmospheric Administration, Environmental Data and Information Service, National Climate Center, Ashville, N.C.

V. Alternative Energy Sources

In this section of the report, a discussion of locally based alternative fuel sources, which can contribute to Alameda's future energy supply, is presented.



1. Biomass

Municipal wastes represent the largest immediate opportunity of utilizing biomass in Alameda. Municipal wastes, including both solid and liquid waste, it is estimated, can generate from five to ten percent of a community's total energy needs. For example, commercial generation of methane gas from a municipal waste landfill site in Mountain view, California, has been in operation about two years. Full expansion of this facility is anticipated to serve 6,000 households.

Financial and environmental control costs of turning municipal waste into useable energy are considerable. But as increased value is placed upon our land and water environments, the difficulty of waste disposal increases, and as costs of new supplies of fuel energy continue to rise, waste-to-energy opportunities will show considerable promise. The City's Bureau of Electricity is currently investigating the feasibility of a waste-fired electrical generating facility.

2. Geothermal

More than 70% of the nation's geohydrothermal (steam and hot water) resources are located in California. The City of Alameda, in conjunction with other members of the Northern California Power Agency, is exploring the use of geothermal fields in the Geyser Areas. It is estimated that these fields may provide up to 30% of the City's current electrical demand.

There are environmental problems involved in the production of geothermal resources, such as alteration of the terrain necessary to provide drill pads, power plant sites and access roads. Hydrogen sulfide presents an air pollution problem when the geothermal steam is vented and condensed in the process of production. Techniques are available for controlling the emission problem which must be utilized. Another problem is that of noise pollution. Occasionally, direct venting of steam is required to protect against pipe rupture from over-pressure during the production process. This venting process, which is extremely noisy, creates a nuisance as well as an occupational risk for those who work near the process and do not wear ear protection. However, with appropriate design, the venting problem can be significantly mitigated.

3. Solar Energy

Solar energy represents a potentially inexhaustible supply of energy over time. It is delivered in an amount far exceeding most communities' forecasted energy needs, if sufficient collection areas and storage strategies and technologies are deployed.
The most obvious means today of using solar energy is low-grade heating needs, such as space heating and the generation of hot water. Low pressure steam can also be generated through the use of focusing collectors for more demanding applications, such as industrial processes and operating certain kinds of mechanical systems.

The terms, "solar orientation" and "passive design" refer to taking advantage of natural flows, such as cross ventilation. It also includes considering the sun's effects on buildings at different times of the year, such as, adequate eaves on the south side of a building, and planting deciduous trees on the south side. Such design would also minimize the use of windows on the north side, and maximize windows on the south side.

While the term "passive design" does not apply to a solar space

or water heating system (referred to as "active design"), it does apply to providing a building design that can accommodate solar panels. A solar greenhouse can be a component of a passive system. Solar greenhousees have the capacity to be added to existing buildings, and may be more adaptive to older buildings than the use of solar panels.

Within the City of Alameda, the potential widespread use of solar energy has certain limitations. The older nature of Alameda's housing stock, as well as the fact that over two-thirds of the residential dwellings in Alameda are not properly oriented for solar utilization, will severely curtail the future use of solar in the City.

Several locations in the City, however, do offer some potential for use of solar energy. In particular, the South Shore area, along San Francisco Bay, appears to be well suited for the use of solar.

The amount of cloud cover Alameda experiences may cause some to hesitate in applying solar systems. For most applications, it is not a formidable obstacle. Most solar hot water systems can function economically on an hour of sunlight a day. Storage tanks and back-up heaters provide additional "insurance."

VI. Conservation Opportunities

The economics of energy conservation should consider life-cycle costings. Life-cycle costings refers to minimizing the total costs of a conservation investment over its life time. To minimize life-cycle costs of a conservation investment, the consumer would trade off an initial increase in his or her capital outlay against present and future savings that would result from decreased energy use.

More specifically, "certain energy conservation actions, such as insulating the attic...(have greater probability to)...pay for themselves in reduced fuel bills. The payback of others is not so certain however. And far from obvious are the exact amounts and combinations of improvements that will result in the maximum possible lifetime savings. The purpose of life-cycle-benefit-cost analysis is the determination of that combination of energy actions which will result in the lowest total cost of improvements plus fuel over the life of the house."*

However, the most effective factor in conservation may be the individual and how he or she uses energy. Wearing a sweater rather than turning up the heat, turning lights and heat off in unoccupied rooms, and consolidating automobile trips for shopping are examples of how everyone could conserve energy without spending any money. There is a limit to the amount of energy we could conserve at no cost without drastic alterations to our presently accepted life styles.

The following are some suggestions for conserving energy in the Stationary and Mobile Sectors:

1. Stationary Sector

Energy conservation may be considered a source of energy. In addition, it saves the user money. As future energy prices go up, the potential savings are greater even though the total bill increases. Conservation in the home or business is something everyone can practice whether they are an owner or a renter. While some conservation measures involve a sizeable initial expense, many conservation techniques can be applied immediately with little or no cost.

Tables 8 and 9 illustrate energy savings that might be expected in a 1200 square foot single-family house by the implementation of various energy conservation measures.

* Wing, Charles, *From The Walls In*, Atlantic Monthly Press, Little Brown and Co., Boston, Mass., 1979.

TABLE 8

ENERGY SAVINGS FOR ENERGY CONSERVATION IMPROVEMENT ON A 1200 SQ. FT. EXISTING HOUSE

	Conservation Actions	Estimated Percentage Energy Savings*
1.	Insulate ceiling from R-9 to R-19	5.0
2.	Insulate floors from R-6 to R-19	8.0
3.	Insulate walls from R-5 to R-19	8.0
4.	Manually turn down thermostat ten degrees (75° to 65°)	0.3
5.	Install automatic thermostat setback (for nightime control)	0.3
6.	Insulate ducts in unheated spaces	1.0
7.	Clean and replace furnace filters	2.0
8.	Install storm windows	8.0
9.	Weatherstrip and caulk	5.0
10.	Insulate hot water heater	2.5
11.	Install shower flow restrictors	4.0
12.	Increase refrigeration temperature by 5°	0.5
13.	Install pilotless range	2.0
14.	Reduce lighting (lower wattage—turn off lights)	1.5
15.	Use clothes line for drying	0.7
		48.8

Source: San Francisco Residential Energy Consumption, Final Report, Office of the Assistant Secretary for Policy, Development and Research, Department of Housing and Urban Development, Washington, D.C., 1976.

Source: Residential Conservation Choices, Portland Energy Conservation Project, City of Portland, Oregon, 1976.

Source: Tips for Energy Savers, U.S. Department of Energy, Washington, D.C. 1979.

TABLE 9

ESTIMATED ENERGY USE FOR A 1200 SQ. FT. SINGLE-FAMILY HOUSE

Use	Estimated Percentage Energy Use
Space Heating	59.0
Water Heating	19.0
Appliances	19.0
Lighting	3.0
	100.0

Appliances included consist of the following:

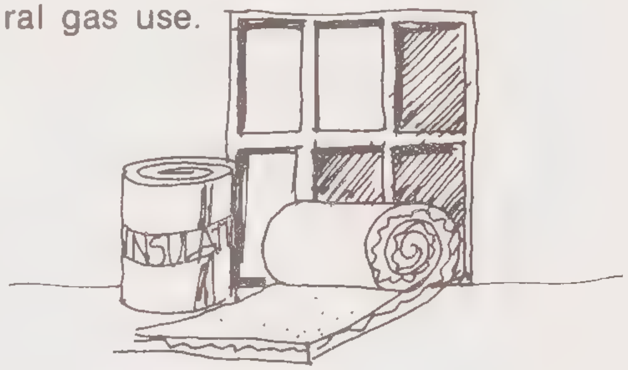
Refrigerator	5.5%
Range	4.0
Dishwasher	1.0
Clothes washer	0.35
Clothes dryer	3.5
Color Television	1.65
Other Miscellaneous	3.0
	19.0

Source: Pacific Gas & Electric Co., Annual Report, San Francisco, 1975.

Source: Residential Conservation Choices, Portland Energy Conservation Project, City of Portland, Oregon, 1976.

a. Space Heating

Space heating is normally the largest part of a residential utility bill (about 2/3). It is also a substantial part of many commercial utility bills. Since natural gas is the primary source of space heating, Figure 3* shows how residential and commercial use reacts to climate in terms of natural gas use.



b. Insulation

Insulating the ceiling in a home to an R-19 standard can reduce by 5% the total home energy load, including both gas and electric.

Proper attic insulation is one of the best investments a homeowner can make. It will reduce energy consumption more than any other single factor, and will literally pay for itself in reduced power bills or minimize their increase. R-19 is the minimum amount of insulation suggested for ceiling, and R-11 for walls. Different types of insulating material produce different R-values at different thicknesses.

c. Thermostat Settings

Sixty-five degrees in winter is the standard President Carter recently ordered for *public* buildings. This requirement has been in effect in California since November 1978 as a result of P.U.C. decision No. 89589. By setting a home thermostat lower when the home is occupied, heating energy use can be reduced significantly for each degree that the thermostat setting is lowered.

* The percentage figures used here will vary with the type of building involved, and the combination of energy saving techniques employed.

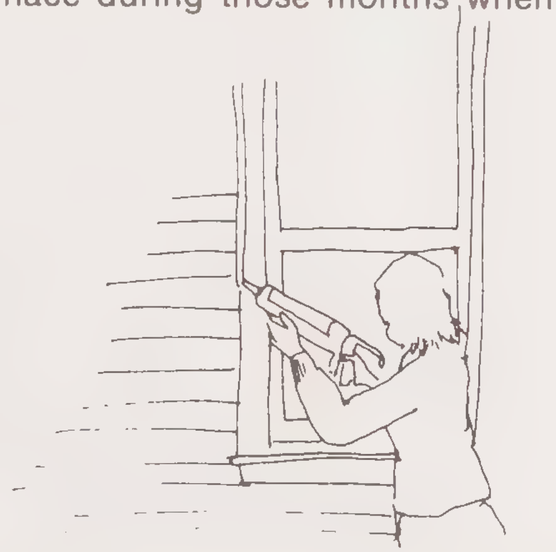
A 10° lower setting at night for a six to eight hour period can save up to 10% in heating energy where no other conservation measures are implemented. An automatic thermostat which changes settings at preset times each day may help. There are a number of different types which can cost from $150.00 plus installation, or it can be a do-it-yourself project.*

d. Ducts

The ducts that carry heated air are another source of energy loss and potential energy savings. Air leaks in ducts can be closed off using duct tape, available at most hardware stores. Where these ducts are exposed to outside air (attic and crawl space), they can be wrapped with insulation.

e. Furnace

The furnace itself can be made to operate more efficiently by keeping clean filters and servicing the motor. In the summer of 1979, PG&E started a major campaign to encourage people to turn the pilot light off in their furnace during those months when space heating is not needed.



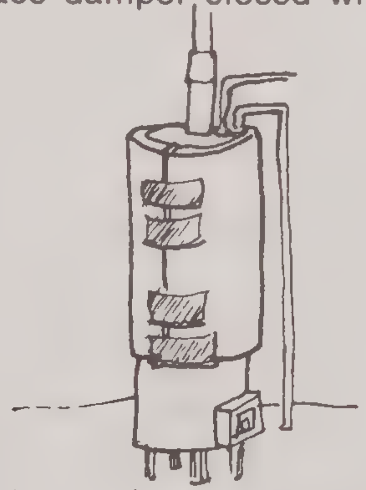
f. Windows and Doors

A drafty home or office is uncomfortable and wastes energy. All doors and windows should be checked for cracks or openings. If light is visible around a door frame, then heat is getting out. Most weather stripping can be installed by the average do-it-

**Caution:* Many energy conservation projects are good do-it-yourself jobs like weatherstripping and caulking. Some, however, involve electrical and gas line work that require special skills and may have to be performed by an electrical or plumbing contractor, etc. Be sure to check the manufacturers specifications and instructions.

yourselfer. Many different types are available - felt strips, foam rubber, flexible vinyl, spring bronze, etc. Caulking plugs up small gaps and cracks on the outside of the house. It comes in different materials and varies as to how well it sticks to surfaces, how long it lasts, how it is applied, and whether it can take paint.

Windows can be modified to reduce heat loss by use of double glazing (adding a second window or installing a new double pane window). An inexpensive way to reduce heat loss is to cover the inside of windows with sheets of clear plastic - available at most hardware stores. However, there are two often-mentioned methods that cost nothing at all. Closing window drapes at night, and keeping the fireplace damper closed when not in use.



g. Water Heating

A gas water heater uses about 20% of the total gas consumed in a gas-heated home, while an electric water heater uses a lesser amouint of electric energy. However, a gas heater is more efficient and cheaper to operate. (The percentage use figure can be misleading due to the total amount of electricity used in the home versus the use of gas for just water and space heating, and perhaps clothes dryer and cooking). These figures may vary widely in Alameda due to the different types of water heaters used, and the incidence of gas use for cooking and clothes drying.

Water heaters can operate with less energy by making a few simple adjustments and improvements. A fiberglass water heater insulation blanket, taped around the tank, can reduce energy use, particularly for those located in unheated areas such as garages. Energy savings will vary with the size and type of water heater, its location, and the temperature at which the water heater thermostat is set.

One of the simplest ways to reduce energy use for hot water is to turn down the temperature control. A "normal" or "medium" setting (about 140°) is sufficient for most households.

Installation of reduced flow shower heads or flow-reducing devices in showers, and low-volume aerators in sinks, can reduce shower water flow rates from about 3 1/2 gallons per minute to about 1 1/2 to 2 1/2 gallons per minute, and reduce sink faucet flow rates about 50%. This saves water and the energy needed to heat the water. A leaky faucet costs money, especially a hot water faucet. Ninety drops of water per minute adds up to more than 200 gallons of wasted water in one month, plus the energy used to heat the water.

h. Refrigeration

The size of the refrigerator and the efficiency of a particular model can also make a difference in usage and costs. A standard 16-cubic foot frostless refrigerator currently costs about $88.00 a year to operate. PG&E estimates that an energy efficient model of the same size would cost about $45.00 a year to operate, a savings of $43.00 a year.

i. Food Preparation

The range represents about 5% of annual energy consumption in the home. Pilotless models use approximately 40% less gas energy per year than those with continuous pilots.

The use of electrical ignitors in new gas ranges, use 40% less gas energy per year than those ranges with continuous pilot lights.

The use of small electric pans, frying pans, pressure cookers and microwave ovens, can also save energy by reducing cooking time in food preparation.

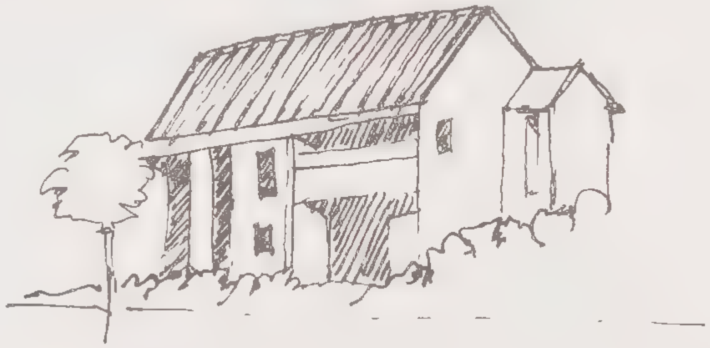
j. Lighting

Home lighting accounts for about 20% of the electricity used annually in the home or 3% of the total energy demand. An incandescent bulb that is turned on for only one second uses only one second's worth of energy. It is more efficient to turn lights off when leaving a room even if it is reentered in a few

minutes. The substitution of one 100-watt incandescent bulb for two 60-watt bulbs yields a 12% energy saving, and provides approximately the same amount of light. Solid State dimmer switches allow more efficient use of energy by allowing the selection of the light needed. Their function and efficiency for both residential and commercial use is contained in Appendix 4. Fluorescent lamps give more light per watt than incandescent bulbs, and last up to 10 times longer. (Note: P.U.C. decision No. 89589 banned the use of natural gas for outdoor and decorative lighting).

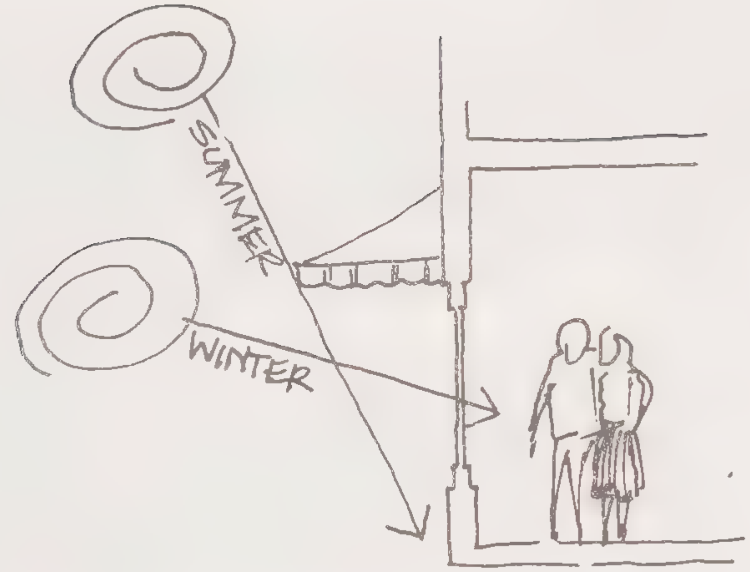
k. Clothes Drying

Electric clothes dryers use about 3 KWH per load, and gas dryers 1/16 of a therm per day. Use of the best alternative—a clothes line seems to be on the decline in new developments; some even have restrictions prohibiting outdoor clothes lines. This may be due to aesthetic concerns, or some feelings that it is out-of-place in a higher priced housing.



l. New Construction

All new construction is required to meet Title 24, the State's new addition to the building code for energy conservation standards. For instance, all new residences must have R-19 insulation in the ceiling, and R-11 in the walls. Beyond that, many builders have chosen to go beyond the standards of Title 24 and obtain PG&E's rating as a Premium Energy Conservation Home. This is a "point system" analysis, where a variety of energy conservation methods can be used in different combinations to achieve an overall level of energy efficiency. A description of the program is included in Appendix 3. Most of the new homes on Bay Farm Island are, or will be, premium energy conservation homes. A great deal could be learned about this program's effectiveness in Alameda by auditing some of the first phases after they have all been occupied for a year, and to compare their average energy use with new homes on Bay Farm Island that are NOT premium energy conservation homes.



m. Solar Orientation in New Construction

The California Legislature passed the "Solar Rights Act" in 1978 (Levine Bill). It requires tentative subdivision maps, to the extent feasible, to provide for future passive or natural heating or cooling opportunities in the subdivision. For example, the lots should be designed so houses can have a southern exposure. The bill also allows cities and counties to pass an ordinance requiring easements on new subdivisions assuring each parcel the right to receive sunlight across adjacent parcels.

In the final analysis, any requirements of new construction should be open to innovations and new technology. Old technology should be reevaluated as well: the use of eaves to provide for summer shading, yet allow winter sunlight in; creating ventilation to take advantage of natural air flows for cooling as well as gravity flow heating in two-story homes.

n. Education Program

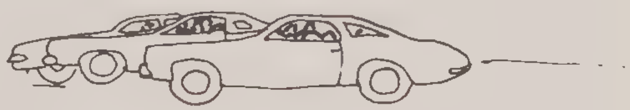
A great number of consumer education programs are being conducted by PG&E and the Bureau of Electricity via billing insert, newspaper ads, television and radio ads, speakers' bureaus, etc. Two characteristics of Alameda may call for some specially designed local programs.

The Planning Department has estimated that approximately 60% of the dwelling units in Alameda are renter-occupied. Renters are not likely to make some of the capital improvements to their homes such as insulation. There are many conservation techniques involving day-to-day operation of a home (or business) that do not require any expenditure.

Most widely distributed consumer information programs on conservation in California, are designed for mass produced standard size tract houses.

These are just a few examples of conservation techniques. More information can be obtained from PG&E and the Bureau of Electricity. PG&E has pamphlets available on many aspects of electricity and natural gas use. While the focus of this conservation discussion has been on occupied homes, many of the techniques can be applied to businesses. In 1977, the Bureau of Electricity offered an energy audit for some large commercial accounts. PG&E has audit manuals available for all types of non-residential uses. The manuals describe specific conservation techniques and how to monitor them. PG&E is presently working with the School District on a School Plant Analysis Program.

2. Mobile Sector



a. Increased Vehicle Efficiencies

Increases in vehicle efficiencies can provide the most immediate savings of fuel energy in the transportation sector. Currently, average fuel economy is estimated to be as low as 13 miles per gallon. It is projected that average fuel economy will be almost double by 1995 with the implementation of Federal fuel economy standards.

It takes 12 years to replace the private automobile portion of our transportation vehicles. The sooner inefficient vehicles can be substituted by more efficient vehicles, the greater the savings will be of fuel energy. In the meantime, individual efforts to drive less will save both money and fuel.

Increased vehicle efficiency can also be achieved through adherence to the speed limit on the highway. Most automobiles get up to 20 percent more miles per gallon traveling at low speeds than at high speeds.

Additionally, having a good car maintenance program such as regular tune-ups, using the gasoline octane and oil grade recommended for your car, keeping the engine filters clean, and checking tire pressure regularly, can result in increased vehicle efficiency.

b. Increased Use of Car Pools and Public Transit

Increased use of public transit can provide additional energy savings by increasing the number of passenger miles traveled in relation to the amount of fuel consumed. Car pools and van pools also represent another means of increasing passenger miles per gallon of fuel.

A three-person car pool uses about one-third of the energy that the three people driving alone would use. About half of all vehicle mileage in Alameda is for commuters to and from work. If the average occupancy (currently 1.13 persons per commuter car), were increased by just one person, not only would each commuter reduce his cost, energy use, but would save Alameda over 11,000 gallons of gasoline per day. This represents about 12% saving in the total amount of gasoline consumed in Alameda driving a year. Car pool programs jointly sponsored by residents, employers, home owner groups and the City, could thus provide substantial fuel savings. Transportation supplements should be a priority in areas AC Transit is reluctant to serve.

Public transit uses one-sixth to one-third the energy per passenger mile that single occupancy cars do.* Public transit in Alameda represents an important means of increasing passenger miles per gallon.

In the DeLeuw Cather study of Bay Farm Island, the transit potential for the island is examined. This study indicates that a significant percentage of people would be willing to use public transit if transit service is improved. Specifically, some of the key issues that the DeLeuw Cather study identified included the questions related to frequency of transit service, dependability, reliability of service, and the issue of the availability of direct transit routes.

* Transportation and Land Use, Portland Energy Conservation Project, City of Portland, Oregon, 1976.

The critical issue with regard to public transit in Alameda is thus, the issue of transit patronage. Presently, many public transit buses are substantially under-occupied during many parts of the day, and therefore, significantly reduces the economics that occur at peak times of the day. It is clear that public transit ridership needs to be promoted in the City if the enormous potential for energy savings in public transit is to be realized. (See Appendices for further discussion on transportation alternatives in the Combined Land Use Plan Recommendations on Transportation).

c. Increased Use of Other Low Energy Travel Modes

Increased use of low energy consuming travel modes, such as bicycling and walking, offer unmatched savings of fuel energy as well as decreasing pollution.

Alameda's generally flat terrain proves an ideal place for bicycling trips. The Combined Land Use Plan recognizes this physical asset in Alameda, and recommends increased bicycle circulation in the City. The Combined Land Use Plan also calls for the implementation of the Bike Route Master Plan, as well as recommending new bikeways for new developments. Provisions for further bicycle lanes throughout the community would enhance the use of this low energy consuming travel mode.

Walking, like bicycling, is another ideal transportation mode. The Combined Land Use Plan is also supportive of pedestrian circulation in Alameda. Additionally, various methods should be identified to encourage walking Alameda, such as priority for sidewalk maintenance, and repair and construction of missing links or gaps in sidewalk systems. (See Appendices for Combined Land Use Recommendations).

d. Telecommunications and Reduced Travel

The substitution of telecommunications for transportation offers a potentially large energy saving in the mobile sector. By means of computer terminals, and other electronic media, vast ranges of two-way information services can become available for shopping, working and leisure activities. Interactive time sharing of computer systems currently provides information exchange for both business and government.

Initial estimates indicate that a 5% reduction in the time spent by "individual travel" can be expected as a result of interactive television. The corresponding reduction in vehicle miles traveled (VMT) is unknown, but is potentially large.

Restrictions on home occupations exist in zoning laws. Some restrictions could be road blocks to attempts to reduce the number of work trips through home occupations.

VII. Alameda's Projected Future Energy Demand

The following demand projections were made for residential, commercial, industrial, and transportation sectors in the City for the year 1995. With regard to the residential sector, estimates for new housing units in the City were obtained from the Combined Land Use Plan (CLUP). The Combined Land Use Plan projects 4200 new housing units to be built in the City by 1985. It is also assumed that an additional 735 units of housing will be built in the City after 1985. Thus, 4935 units could be projected to be added to the housing stock in Alameda by 1995. Without more specific data, it is assumed that energy consumption in these new units will reflect a slightly lower energy demand pattern than in existing older housing units. The following Table reflects new energy demand in the following residential sectors in 1995:

TABLE 10

1995 NEW RESIDENTIAL ENERGY USE IN ALAMEDA

		Energy Use (Billions of BTU's)
Harbor Bay Isle		275
Alameda Marina Village		85
Other selected sites on Main Island and Bay Farm Island		63
	Total	423

Source: Combined Land Use Plan, City of Alameda, 1977.

Source: San Leandro Bay Transportation Study, Working Paper II, Land Use, Population and Employment. Alameda County, 1977.

TABLE 11

1995 NEW INDUSTRIAL AND COMMERCIAL ENERGY USE IN ALAMEDA

		New Jobs	Million BTU's per Job	Billions BTU's
Industrial				
Manufacturing		200	910	182
Construction		600	143	86
Other Industrial		200	101	20
Commercial				
Wholesale & Retail		2,800	115	322
Services		1,800	133	239
	Total	6,300		849

Source: Draft Environmental Report, *"The Proposed Alameda Marina Village,"* Earthmetrics, Inc. Palo Alto, California, 1979.

Source: Draft Environmental Impact Report *"Harbor Bay Isle, A Residential/Industrial Development on Bay Farm Island, City of Alameda,"* Arthur D. Little, Inc. 1973.

Source: *Summary of Conservation Choices*, Portland Energy Conservation Project, City of Portland, Oregon, 1976.

With respect to the commercial and industrial sectors, specific growth numbers for employment activities were determined from various sources. It is estimated that 6,000 new jobs will be created in Alameda by 1995. This projection includes commercial and industrial activities associated with both Bay Farm Island and Alameda Marina Village. It is thus possible to relate specific growth number for various employment activities to average energy consumption by job. Table 11 exhibits the results of data on employment in Alameda with regard to energy consumption.

New transportation energy demand in Alameda is projected to be 369 billion BTU's. This represents a 16 percent increase in energy demand from 1977-1978. This new energy demand is reflected by the fact that by 1995, 4,935 new households will be added to the present population in Alameda. It is assumed that each household, on the average, will drive 13,900 miles per year. The data exhibited in Table 12 presents energy demand in the transportation sector in the City in 1995.

TABLE 12

1995 NEW TRANSPORTATION ENERGY IN ALAMEDA

	Household Units	Million VMT* by Project	Million Gallons Gasoline by Project	Billion BTU's by New Development
Harbor Bay Isle	3,200	44.5	1.7	202
Alameda Marina Village	1,000	13.9	.5	60
Other Selcted Sites	735	10.2	.4	48
Total	4,935	68.6	2.6	310

Assumptions:

1. *Household Travel:* Household travel will increase from 12,600 to 13,900 miles per year by 1995 in both new and existing households as to household travel in 1979.

2. *Vehicle Efficiency:* Automobile efficiency will be 26 miles per gallon by 1995.

*VMT is the abbreviation for Vehicle Miles Traveled.

For comparison purposes, an estimate of future energy use was determined for both a "Present Energy Policies Option" and a "Conservation Energy Policies Option" (see Energy Policy Recommendation Section).

In the City of Alameda in 1995, a "Present Energy Policies Option" represents a continuation into the future of current energy use, as well as assuming a certain amount of growth will occur in population, employment and travel. The "Present Energy Policies Option" also assumes that NO energy recommendations (see Energy Policy Recommendation Section) are adopted by the City.

A "Conservation Energy Policies Option" assumes that a certain amount of growth will occur in population, employment, and travel in Alameda. In addition, the "Conservation Energy Policies Option" (see Energy Policy Recommendation Section) assumes that ALL Energy Policy Recommendations are adopted by the City.

Table 13 statistically illustrates a "Present Energy Policies Option" and a "Conservation Energy Policies Option."

TABLE 13

FUTURE ENERGY DEMAND

			Future Energy Demand	
Sector	*Existing Energy Demand (1977-78)*	*1995 New Energy Demand*	*Present Energy Policies Option*	*Conservation Energy Policies Option**
(1)Residential	1,973	423	2,416	1,812
(2)Commercial	1,279	561	1,840	1,748
(3)Industrial	1,398	288	1,686	1,602
(4)Transportation	2,728	310	3.038	2,279
Total	7,378	1,582	8,980	7,441

***Assumptions**

(1) *Residential:* A 25% reduction in energy demand is expected in this sector by 1995. Energy policies affecting the Residential Sector will be adopted by the City.

(2) *Commercial:* A 5% reduction in this energy demand is expected in this sector by 1995. It is assumed that all energy policies affecting the Commercial Sector will be adopted by the City.

(3) *Industrial:* A 5% reduction in energy demand is expected in this sector by 1995. It is assumed that all energy policies affecting the Industrial Sector will be adopted by the City.

(4) *Transportation:* A 25% reduction in the energy demand is expected in this sector by 1995. It is assumed that all energy policies affecting the Transportation Sector will be adopted by the City.

VIII. Energy Responsibilities

The purpose of this section is to outline the current roles of both governmental energy agencies and private institutions with regard to future energy use in the City of Alameda.

1. Individual's Role

Volunteer conservation presents the individual with the most options. One option is car pooling or public transit. Another option is insulation and/or weatherstripping. It involves identifying the option easiest to implement on an individual basis. The traveling sales representative may need his car in his business, and have too much material to use a bus, but he can weatherize his home. A senior citizen or handicapped person may not be able to walk to the store, but they may be able to insulate their residences. There are programs that provide financial assistance to low-income households for installing insulation.

Every individual should reevaluate his own energy use, and reduce his energy use accordingly by the simplest method. It could be by using the clothesline more, turning down the thermostat and putting on a sweater, or eliminating some unnecessary automobile trips.

Water conservation was widely practiced during the drought, largely because of mandatory allocations, but many citizens saved more water than the allocations required. As with water allocations, some mandates may have to occur to get the individual to act. A simple requirement, however, could produce greater results than expected because of its educational value.

2. City of Alameda's Role

Through the various departmental levels, the City can play a major role in energy conservation. The following briefly identifies departmental divisions, and describes their potential roles they could play in determining Alameda's energy future.

a. City Manager's Office

Comprising the management, finance and general support services to City government, the City Manager's office has the opportunity to demonstrate to the community at large, the City's own commitment to energy conservation. Imposing conservation measures on the City's own operations, and introducing the life-cycle cost concept into its capital budgeting and purchasing system, are two possible options.

b. Planning

The Planning Department of the City has many opportunities to influence the use of energy conservation and alternative energy technologies. The Planning Department can influence future community-wide energy performance and environmental quality through application of its regulatory and permit granting processes.

c. Personnel

The Personnel Department, through their current responsibilities for testing, selecting, and training City personnel, could include energy orientation and education for employees. This effort could concentrate upon imparting knowledge to employees about current City activities and programs which are attempting to solve the problem, and ways City employees could conserve energy with regard to their particular jobs.

d. Police and Fire

The Police Department and Fire Department have traditional responsibilities for the safety, law enforcement, and protection of the community. They also can continue to improve efficient use of gasoline in their mobile operations.

e. Recreation

The Recreation Department with their contacts with large numbers of Alamedans, could disseminate information on energy conservation measures. The Department could also provide the organization for workshops on energy conservation. Additionally, Recreation has responsibility for the Golf Course operation, which utilizes electricity, gasoline and diesel fuel.

f. Department of Public Works

The Public Works Department, having responsibility for building

inspection and streets, could influence energy conservation in both the stationary and mobile sectors.

Currently, the Building Inspections Office is responsible for administering and applying the State's Title 24 energy conservations standards for all new buildings built in Alameda. If the City adopts further conservation standards of their own, the Building Office will be assigned the responsibility for the implementation of these standards.

The Engineering Office may also encourage energy saving opportunities in the transportation sector by increasing vehicle efficiencies through continued roadway signalization design, and assuring use of efficient street lighting design—a major energy cost for any city government.

g. Bureau of Electricity

The Bureau of Electricity began operation in 1888, and is believed to be the second oldest municipal electric utility in the United States. The Bureau generated its own electric power supply until 1924, when, for economic reasons, it began purchasing its power supply from others.

The Public Utilities Board is responsible for the control and management of all public utilities owned by the City for the purpose of generating, distributing, or selling gas, electricity, or furnishing transportation.* The Bureau of Electricity currently distributes only electricity to the Alameda community. The Bureau of Electricity is directed by a five-member Public Utilities Board.

Through the Northern California Power Agency, the Bureau will be implementing a Residential Energy Conservation Program, and pursuing the use of geothermal and hydro power. The Bureau is also investigating the feasibility of constructing a solid waste-fired electric generating station in Alameda as a supplement to fossil fuel.

With the potential powers to manage the City's electric and transportation systems, the Bureau of Electricity can play a major role in influencing community-wide energy conservation.

* Article XII, Sec. 12-1(A) Page 20, City Charter

h. Library

The Library can participate as a community education center through its traditional collections of material, as well as its bulletin board. A typical example is the use of the reading material display case, which recently included a collection of publications on energy conservation.

3. Federal Government's Role

Although the role of the Federal Government presently emphasizes the broad nationwide scale of the energy problem, valuable information, research data, advice, funding, and other guidance to individual communities can be expected. The Department of Energy (DOE), formed this past year, is the single functional agency dealing with the national energy problem.

In addition to DOE, the Federal Community Services Administration (CSA), and the Department of Housing and Urban Development (HUD) likewise administer assistance programs to local governments. These agencies primarily focus on weatherization programs.

The National Energy Plan, adopted this past year, contains provisions which can assist in the development of community energy systems. The Plan calls for Federal tax incentives for the expanded use of solar and wind generated energy, co-generation,* and the efficient use of energy resources. Also, municipal co-generation facilities may be exempted in whole or part from Federal and State public utility regulation.

The rate at which these local community alternative energy systems are developed, will partially depend upon the final mix of tax credits, federally sponsored research and the development, funding assistance, and other programs enacted at the Federal level.

4. State Government's Role

Passage of the Warren-Alquist Act, May 1, 1974, created a permanent State of California Energy Commission. It serves as

* Co-generation: is the utilization of waste heat from industrial processes to generate electrical energy.

the State government's central agency for all energy related matters. The Commission's program pertinent to the Alameda community includes the development of standards for conservation, coordination and formulation of research and development programs, collection of energy data and information, and the administration of state tax credits for solar energy systems.

The Commission's Conservation Division currently administers a federally assisted program for community energy conservation and planning which provided partial funding for this particular study.

The State's Public Utility Commission (PUC) also plays a major role in California's energy picture. Their responsibilities include fuel resource allocation and rate approval which affects investment in additional energy supply systems.

As with the Federal government, the future availability and level of State assistance to local governments will affect, to a degree, the rate at which Alameda can develop alternative energy systems.

5. Northern California Power Agency's Role

The Northern California Power Agency (NCPA) is a joint powers agency formed in 1968 under the laws of the State of California. NCPA's membership consists of eleven Northern California cities, all of which own and operate their own electric distribution systems, and the Plumas-Sierra Rural Electric Cooperative.

NCPA was founded for two general purposes. One, it provides for cooperative efforts with regard to challenging rate increases for bulk power purchased under wholesale rates, all of which are controlled by the Federal Energy Regulatory Commission. (Some of the members of NCPA receive all or part of their bulk power from the Central Valley Project of the Bureau of Reclamation, another Federal agency), and the other purchased bulk power from PG&E. Secondly, NCPA explores the technical and economic feasibility of the development of electric power generating facilities for use by its members, and investigates other sources of electric supply. NCPA communities have embarked upon a joint Residential Energy Conservation Program. The City of Alameda, through the Bureau of Electricity, will be participating in this program in the fall of 1979. The program involves an auditing procedure of residential customers, development of conservation measures, and initiating a "report card" billing process.

NCPA is currently in the process of developing two geothermal power plants in Lake and Sonoma Counties, and a hydroelectric "peaking" plant in Calaveras County. It has also acquired contracts for dump power from the Pacific Northwest from a number of electric utilities in that area. It is anticipated that within the near future, NCPA will have developed or acquired a number of electric power resources which will be operated in a "pooled" fashion for the benefit of its members.

6. Utility Company's Role (Pacific Gas & Electric Company)

The investor-owned utility company providing gas to the Alameda community, has taken an active role in promoting energy conservation in the community.

PG&E conducts free energy audits by state qualified energy auditors for residential, commercial and industrial customers.

PG&E provides low interest loans to residential customers interested in having their homes insulated.

PG&E provides information in energy conservation through its monthly billing system and individual therm usage information which compares present usage with last year's usage.

7. The Developer's Role

The greatest area of participation on the part of the development community (comprised of land holders, land developers, building designers, builders, lenders, and real estate brokers), will be in the design, financing, construction and sale of Alameda's built environment. Developers should be receptive to new innovations in energy conservation and solar techniques.

The City's major builder of new homes, Harbor Bay Isle Associates and their partners, have utilized PG&E's energy conservation standards.

IX. Conformance With General Plan Policy

The "Tentative Goals" of this Energy Element, as identified in the previous section, were assessed in relation to the City of Alameda's adopted policy for the purpose of determining if any inconsistencies exist. *Goals for Alameda*, the final report of the Community Goals Study, developed goals for eight subject areas: crime prevention; economic development; education; housing and physical planning; human services; planned growth; recreation and cultural facilities, and transportation. The goals contained in *Goals for Alameda* were reviewed and found to be consistent with the tentative goals relating to energy.

The Combined Land Use Plan provides a series of recommendations on alternatives to the automobile. These are listed in the Appendix. The Issues section of that Plan also reviews the existing bus system, both in terms of present efficiency, areas served and conditions for expansion.

The Noise Element requires certain minimum standards for noise insulation in certain areas. These methods can also be energy conserving in some cases (insulation and double windows), but increase energy use in others (ventilation and air exchange requirements).

Conclusions

1. It is vital for our Nation's economy, and for the City of Alameda to reduce our reliance on fossil fuels. This may be done by the use of alternative sources of energy and/or conservation.

2. Conservation of our fossil fuels is the most reliable method of reducing our dependency on fuels.

3. The City, the property owner, the resident, and the business community of Alameda must each strive to reduce their consumption of fuels.

4. The City should encourage mass transit service improvement within Alameda.

5. There should be a continuous effort by the City, Pacific Gas & Electric and the Bureau of Electricity, to educate the consumer on energy conservation practices.

6. The City should implement this plan by ordinances, policies, and educational programs.

X. Goals and Objectives*

GOAL #1: Decrease the community's dependence upon fossil fuel.

1. *Sub-goal:* Efficient energy utilization.
   Objective: Reduction of individual consumer's energy consumption.
2. Sub-goal: Develop and implement alternative energy sources.
   Objective: Encourage installation of alternative energy devices on residences and businesses where appropriate.
3. *Sub-goal:* Develop energy efficient transportation systems.
   Objective: Improve traffic flow, bus ridership, car pooling and bike paths.
4. *Sub-Goal:* Estimate contribution and cost of present and future alternative energy sources, including geothermal.
   Objective: Select alternative sources based on criteria of initial cost, energy savings, environmental impacts, critical usage and feasibility.
5. *Sub-goal:* Establish performance standards as appropriate and feasible for local conditions.
   Objective: Evaluate, implement and monitor federal, state and local regulations for efficient energy consuming equipment and encourage the retrofit of Climate Control equipment.
6. *Sub-goal:* Increase usage of energy conservation and alternative energy uses by providing financial incentives.
   Objective: Provide municipal (other) tax incentives for the installation of alternative energy devices.
7. *Sub-goal:* Optimize environmental and economic relationships in all energy considerations.
   Objective: To evaluate both the economic and environmental energy conservation alternatives.

GOAL #2: Increase the number of options available to the City for satisfying future energy needs, and for influencing the allocation and use of energy.

1. *Sub-Goal:* Insure that State and Federal regulations help Alameda.
   Objective: To actively monitor and influence State and Federal energy regulations and policy.
2. *Sub-goal:* Utilize City regulatory powers to insure the use of current energy technology, and to increase energy efficiency in the community.
   Objective: To use permit and licensing procedures and utility authority to promote energy efficiency, and facilitate the use of alternate energy sources.
3. *Sub-goal:* Promote individual consumer awareness and support for energy conservation measures.
   Objective: To keep the public informed about energy conservation and energy alternatives.
4. *Sub-goal:* Explore alternative programs for power generation.
   Objective: Make Alameda energy self-sufficient.

GOAL #3: Provide timely responses to the community energy needs which balance Alameda's physical, environmental, economic, and socio-political considerations.

1. *Sub-goal:* Recognize Alameda's unique characteristics which affect energy supply and consumption.
   Objective: To assess the balance and consistency of energy programs with the General Plan.
2. *Sub-goal:* Develop a practical and timely framework for implementation of energy problems.
   Obvective: To fix target dates for meeting short-range and long-range energy goals.
3. *Sub-goal:* Perform continuous auditing of energy availability and consumption.
   Objective: To assess and adjust Alameda's effective efforts to conserve fossil fuels.
4. *Sub-goal:* To periodically review the effectiveness of various energy conservation measures enacted by the City of Alameda, and recommend actions to the City Council.
   Objective: To develop cost and price relationships for a long-term energy management plan.

* Adopted by the Energy Conservation Committee.

XI. Energy Policy Recommendations

The conservation of fossil fuel and the encouragement of development of alternative types of energy will become increasingly important to Alameda in the years to come. The accomplishment of the goals that the Energy Conservation Committee is proposing, requires the cooperation of the entire

community. Each citizen in his own way, must do his part. The City government cannot do it alone.

The Policy Recommendations listed below suggest a variety of ways in which to achieve the Goals presented in this document. None of these recommendations will be prohibitively costly to the City, or to its residents, and businesses, although some will take time to implement. All of them seek to reduce dependence on fossil fuels.

Implementation

1. The City should establish an Office of Energy Conservation. The Director of this office would be charged with coordinating efforts to implement approved policy recommendations. The Director need not be assigned full time to this position.

2. The City should establish a permanent Citizen's Energy Committee to oversee the work of the Office of Energy Conservation.

Transportation

1. The City should encourage energy efficient transportation priority to the implementation of the policies adopted in the Combined Land Use Plan for the improvement and extension of alternative transportation means. These include:

a. Expansion of Public Transit
b. Increased car and van pooling
c. Improved means for bicycle circulation
d. Increased provisions for pedestrian access to bridges, parking lots and shopping centers.

2. In this connection, the City should establish "Park and Ride" lots for convenient bus connections and car pooling.

3. The City should review street patterns and traffic controls to determine areas where traffic flows can be improved.

Facility Design and Improvements

1. The City should actively enforce the energy conservation requirements contained in Title 24 of the Uniform Buiding Code.

2. The City should encourage developers to design structures which, as a minimum, meet PG&E's standards for a Premium Energy Conservation Home.

3. The City should encourage developers to consider the latest passive and active solar energy techniques in site and building layout and design.

4. The City should develop a program to encourage and assist building owners to install energy conservation measures in existing structures.

5. The City, in cooperation with the Bureau of Electricity, PG&E, the Board of Realtors, etc., should develop a set of "Premium Energy Conservation Home" standards which apply to home resales.

6. The City should require that by 1982, the owners of heated swimming pools install pool covers or solar heating.

7. The City should develop procedures for granting city property tax rebates when energy saving improvements are installed in existing structures.

8. The City should modify regulations governing signs and outdoor lighting to include requirements for use of energy efficient fixtures.

9. The City should complete a comprehensive energy audit of all City-owned facilities and lighting systems as soon as practicable, but no later than 1981, and should encourage residents, and owners of businesses and industrial establishments, to conduct similar audits.

10. The City should establish a priority list of energy conservation measures applying to City facilities which are determined by the audit, and accomplish these as funds become available. For example: alternate motor vehicle fuel and more efficient street lighting.

11. The City should encourage the Bureau of Electricity to continue to investigate the feasibility of constructing a solid waste fired electric generating station.

Energy Education

1. The City should work with the Bureau of Electricity and PG&E to develop energy conservation handbooks for distribution in Alameda.

2. The City should undertake an evaluation of the effectiveness of roof and wall insulation in existing structures by means of aerial infrared photos. Results of the evaluation should be used in energy education programs.

Energy Legislation

1. The City should support regional, state and national efforts to enact energy legislation which promotes the accomplishment of Alameda's Energy Conservation Goals.

2. In the accomplishment of the Energy Conservation Goals, the City, and all of its agencies, should be concerned with the consequences which can unreasonably alter or degrade the quality of life in Alameda. To this end, attention must be given to: 1) the initial and long term cost of implementation; 2) the environmental results, including life style impacts; 3) the evaluation of potential energy payback in specific projects; and 4) the availability of proven technology to accomplish specific objectives.

Environmental Impact Report

1. Summary

The potential effects the Energy Element would have on the nature and social environment of Alameda are examined in this section of the report, as well as throughout the report.

Implementation of the Energy Element Recommendations would have negligible impacts on Alameda. Table 14 summarizes the environmental impacts from various energy technologies on Alameda.

2. The No-Plan Alternative

This is a continuation of the status quo - the course of events if Alameda did not adopt an Energy Element and Energy Recommendations, and did not implement the new programs discussed in the Element. This discussion is included in compliance with the California Environmental Quality Act.

Energy conservation programs would still occur, promoted by PG&E and the Bureau of Electricity, but their acceptance and the application might not reach as many users.

New homes would be constructed with fewer energy conservation methods, although some new homes might still be constructed as premium energy conservation homes on a voluntary basis.

Automobile usage and gasoline usage would stay the same or increase. City government decisions might be made without any evaluation of energy alternatives.

3. Other Impacts

Several of the implementation options may be suspected of having a significant impact in terms of increased housing costs. This may be true in terms of initial purchase price, but is mitigated by the reduced long-term operating costs and reduced usage of energy. For example, when an existing house is sold, and insulation, weatherstripping, etc., has to be installed, the cost of these improvements will probably be reflected in a higher sales price. Using current costs, it is estimated that as much as $250.00 to $1,000.00 could be added to the sales price, if the house has to be fully insulated in the ceiling.

The owner of a rental house has little financial incentive to weatherize if the renters pay the energy bill. Renters may be reluctant to make physical improvements to property they do not own. If the City requires a weatherization program at the time of resale, it should also apply to rental structures.

The present energy technologies for conserving energy from fossil fuels may require greater use of renewable resources such as, wood for burning, farm products for methanol, etc. In the manufacturing of solar equipment and wind generating equipment, nonrenewable resources (copper, aluminum, steel, etc.) are utilized. It may be, that as technology improves, use of nonrenewable resources may be reduced.

4. ENVIRONMENTAL IMPACTS FOR ALTERNATIVE ENERGY TECHNOLOGIES

ALTERNATIVE ENERGY SOURCES	ENVIRONMENTAL IMPACTS: LAND USE	WATER QUALITY	AIR	NOISE	ECOLOGICAL	AESTHETIC	OTHER
BIOMASS (Solid Waste Plant)	▲	▽	▲	▽	▽	▽	▲
GEOTHERMAL	▽	▽	▽	▽	▽	▽	▽
HYDRO	▽	▽	▽	▽	▽	▽	▽
SOLAR	▽	▽	▽	▽	▽	▽	▽
WIND	▽	▽	▽	▽	▽	▽	▽

▲ = Resultant impact could be significant
▽ = Resultant impact will NOT be significant

Appendices
"A Primer of Alternative Fuel Sources"*

1. Biomass

1979 DOE budget: $44 million.
Source: Organic materials ranging from plants like trees and corn to garbage, sewage and manure. They can be burned directly - an idea as old as the campfire - or converted to gas or liquid fuel.

Potential: Depending on where the biomass fuel is, a promising supplement to stretch shrinking supplies of conventional fuels. In cities, farms and forests, plenty of waste is generated each day that could be energy prospects instead of disposal problems.

Status: In the Midwest, and in the California state motor vehicle pool, alcohol made from wood or grain is being added to increasingly scarce and costly gasoline. On the big island of Hawaii, the residues from sugar cane fields provide almost half the elctrical power generation. In Eugene, Oregon, the public utility board is buying the wood slashings left over from neighboring logging operations to burn in its steam generating plant. All over the country people are retrieving garbage, old car seats, peach pits, cow manure, spoiled corn, sewage and sawdust to make energy. Scientists are also working on new forms of fuel from biomass. A Lawrence Berkeley Laboratory team has produced no-sulfur oil from Douglas fir chips in an experimental plant in Oregon.

Problems: Gathering of the waste material (biomass) fuels tend to be dispersed over large areas, making them difficult or expensive to collect for central power (generation); possibly, competition for land space with food or lumber crops in the case of biomass faring - growing high-yield plants expressly for fuel.

* "A Primer of Alternative Fuel Sources," Marcie Rasmussen, reprinted by permission, San Francisco Chronicle, July 18, 1979©

2. Coal

1979 DOE budget: $160 million for coal liquifaction: $175 million for coal gasification.

Source: Coal, mined or left underground converted to other fuel forms by a variety of complex processes, which mostly involve adding hydrogen and heating under pressure.

Potential: Abundant; some experts estimate the known recoverable U.S. coal resources of 400 billion tons could expand to 1800 billion tons through underground coal gasification, just one method being tested now.

Status: Coal gas fed London's 19th Century street lamps; coal oil powered German's World War II tanks and planes. But the idea of transforming lumpy, polluting black coal into clean synthetic fuels here was blocked time and again by high costs and other problems. Now that conventional oil is more expensive and less available, synthetic fuels made from coal are a hot item both in President Carter's energy program and in Congress, where legislation is being considered to speed up the development schedule. Southern California Edison is planning to build a power plant near Barstow using gas from coal.

Problem: Expense; experts predict coal fuels will be more costly than shale oil and half again as expensive as current oil imports; health and safety aspects of coal mining, where mining is needed; social and environmental impacts of energy development on the mountain states, which face the brunt of national synfuel proposals; concern by scientists that synfuels could generate so much heat-trapping carbon dioxide that global weather changes would result; technologies are largely unproven on commercial scale."

3. Breeder Reactor

1979 DOE budget: $742 million.
Source: Nuclear fission reaction, making heat to generate power.

Potential: Virtually self-perpetuating, since the reactor "breeds" its own fuel, producing more plutonium than it uses.

Status: France operates the "Phoenix" breeder reactor and is building a "Super Phoenix." The U.S. test breeder in Utah has

been operating for about 25 years. The Germans and Russians are also working on breeders, and international efforts are planned. In the United States, Congress and President Carter are at odds over the proposed $2.2 billion Clinch River reactor in Tennessee. Carter prefers to scrap the project and start over with a new breeder design.

Problems: New optimistic estimates of easily recoverable U.S. uranium reserves may set back the breeder timetable since it would not be needed so soon to compensate for a dwindling supply of nuclear fuel; breeders and whether to have them at all are an intrinsic part of the whole national debate over nuclear power; hazards associated with liquid sodium coolant and production of weapons-quality plutonium.

4. Fuel Cells

1979 DOE budget: $41 million.
Source: A batterylike device to convert the energy of liquid or gas fuels to electricity by a chemical process rather than combustion.

Potential: A cleaner, more efficient way to produce power in plants built in modules to fit the particular needs of a community as it grows.

Status: A small demonstration fuel cell plant is being built in New York and should be generating up to 4500 kilowatts of power by next year. Scientists are also working on more advanced fuel cells. Fuel cells can use new synthetic fuels as well as conventional petroleum. Researchers say methyl alcohol is one of the most promising alternative fuels for cells.

Problems: Improving the endurance of fuel cells in stacks, or large scale series; lowering costs from a current research price of about $3000 per kilowatt.

5. Geothermal

1979 DOE budget: $158 million.
Source: Geysers, hot springs, volcanoes and underground pools of molten rock.

Potential: Possibly as much as the entire U.S. generating capacity of about 450,000 megawatts of power, according to some estimates, if scientists can learn how to tap energy directly from molten rock.

Status: Electrical power and experimentally, industrial process heat. Used in Italy, Iceland, Japan, New Zealand, Mexico and California, where steam from geysers near Geyserville turn generators that provide about 4 percent of PG&E's power supply. New test plants are under way in the Imperial Valley and in New Mexico; other experiments are being conducted in Hawaii.

Problems: Overcoming economic and technical obstacles blocking geothermal development of known resources in regions other than the Geysers field; controlling smelly gases and allaying fears that geothermal wells might wreck the underground plumbing of sites like Yellowstone National Park.

6. Ocean

1979 DOE budget: $38 million.
Source: Currents, tides, waves and temperature differences between warm surface waters and cold ocean depths.

Potential: Primarily as a power supply booster for islands and coastal areas where the electricity can be cabled ashore with minimal losses. But some experts predict ocean power systems could provide as much electricity in 2000 as hydroelectric dams on land do now, equivalent to some 575 million barrels of oil.

Status: An old Navy barge with a 2170-foot pipe trailing underneath and a machine that works "like a refrigerator backwards" floats off the Kona coast of Hawaii, where researchers are about to flip the switch on the world's first ocean-born electricity. The process is Ocean Thermal Energy Conversion, and if it works, it could play a big part in the future of Hawaii and other tropical areas. OTEC depends on warm water to heat a substance like ammonia to steam - and cold water to change it back to liquid again. The steam runs a generator. Power is generated by the changing tides at small plants in France and the Soviet Union.

Problems: Unproven technologies; geographical limitations, possible interference with marine life.

7. Shale

1979 DOE budget: $49 million.
Source: Geologic oddities like the Green River formation in the Rockies, where hard gray shale contains an organic substance called kerogen, which breaks down into oil and gas.

Potential: 1.5 to 2 million recoverable barrels a day of synthetic oil for a century, according to federal officials - or about 10 percent of the nation's current daily oil use.

Status: One of the pet projects of an administration and a Congress anxious to reduce dependence on foreign oil. Oil companies have been working in the field for years to learn how to recover shale oil in large quantities, and combat the accompanying tough environmental issues. Union Oil wants to build a shale oil plant in Colorado. Current proposals to speed shale oil development include a $3 per barrel tax credit, a guaranteed subsidized federal market for large amounts of shale oil by 1985 and streamlined permit processing.

Oil is found locked not only in shale rock but also in sand. The U.S. has some deposits of tar sand, but the biggest reserves, of an estimated 800 million barrels, are in the Canadian prairie provinces. International agreements are in the works to find ways to increase the production of oil from tar sand from a current level of 90,000 barrels a day at Alberta plants.

Problems: Environmental (air and water pollution, landscape disruption, disposal of enormous amounts of crushed rock after oil is extracted) and social (possible water rights disputes in the water-conscious West, impact of energy development in the Rocky Mountain states).

8. Solar

1979 DOE budget: $104 million for photovoltaic cells; $100 million for thermal electric projects; $156 million for demonstration programs.

Source: The sun.

Potential: Boundless, but experts differ bitterly over whether and when solar devices can provide the answer to energy problems. The President's current goal is for solar sources (including wind, water and biomass systems) to provide 20 percent of the nation's energy by the year 2000.

Status: An estimated 50,000 American homes are now "solarized" to some degree, using sunlight to heat water or interior air, a figure that could double by next year.

Solar collectors heat other kinds of buildings and fuel some industrial processes, mostly in demonstration projects. But solar devices are more available than used, partly because of institutional constraints. "The way we keep our accounts and pay our taxes tends to work against the up-front investment a solar system represents," says Dana Morgan of the Solar Energy Research Institute. "There is a reluctance by industry at present to invest." Other conventional forms of energy - such as oil and nuclear power - have been subsidized for years, notes another official.

Besides "active" solar collector systems, increasing attention is given to "passive" solar design (taking advantage of siting and other considerations for natural air conditioning) in new homes, viewed as a cheaper alternative than conventional systems for a large share of heating needs.

9. Sunsat

1979 budget: $8 million, NASA and Department of Energy

Source: Solar energy collected 22,3000 miles in space on enormous satellites and beamed to earth via microwaves. The engineers who put man on the moon a decade ago are beginning to lobby for this potential new focus to revive the waning space program.

Potential: Long range. Through billions of solar cells on the "Sunsats," a power supply from each satellite of 5000 megawatts, roughly the amount supplied by five nuclear reactors.

Status: Theoretical at this point. But Peter E. Glaser, the engineer who first suggested Sunsat in 1968, argues that a prototype satellite could be developed by the 1990s with an all-out effort. Congress is considering whether to raise the research budget to $25 million a year.

Problems: Economic (each satellite would cost an estimated $12 billion, extend over an area 3.3 miles wide by 6.5 miles long and be built by crews of hundreds in orbiting workshops); environmental (unknowns regarding the effect of beaming microwave radiation at earthly life, the effect of heating the ionosphere, possible interference with navigation and communications) and political (military potential).

10. Wind

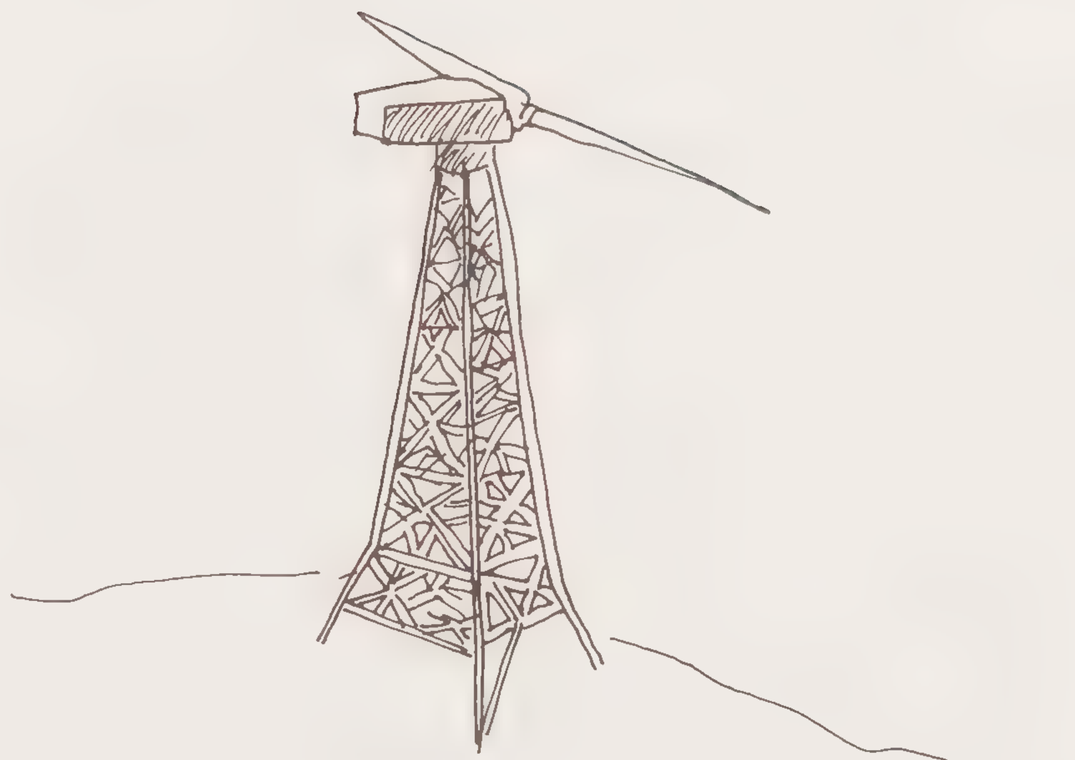
1979 DOE budget: $61 million.

Source: The wind, caught by the blades of windmills and modern wind turbine generators — some with arms like jumbo jet wings and others shaped like huge eggbeaters.

Potential: Endlessly renewable, but subject to the vagaries of weather. Energy is only produced when the wind blows strong enough to spin a power-generating mechanism. But researchers see "definite potential" in wind-power, especially for utilities that now depend on oil.

Status: At the end of the last century, there were millions of windmills across the rural American landscape. By the turn of the next, many could be back, in modern form. Federal officials say 28 firms nationwide are making wind machines ranging in size from small housetop models to the world's largest, a two-megawatt capacity giant in Boone, N.C. Southern California Edison plans to complete an even larger windmill by late summer near Palm Springs, potential forerunner to a wind contingent of 20 or more machines. The state Department of Water Resources envisions getting windpower for its water pumps by 1983 from a proposed 500-machine project at Pacheco Pass; someday the state Water Project might be partly pumped by 2000 machines, at a cost of $14 million but a considerable savings in oil.

Problems: A lack of detailed data about wind characteristics in any given area of California; storage of excess energy for calm periods, except when a utility grid system is available; possibly, aesthetics in the case of a large field of machines.



Combined Land Use Plan Transportation Alternatives

Public Transit

1. The City should work with AC Transit to achieve the following:
   a. Development of bus routes within the Northside and Estuary areas.
   b. Increased frequency of bus service to Bay Farm Island and development of service to new developments on Bay Farm Island.
   c. Introduction of smaller, lighter buses, such as mini-buses, which are suitable for residential streets.
   d. Development of frequent connections to BART from all parts of the City.
   e. Development of service for people with special transportation needs, such as service to senior citizen programs.
   f. Publicizing and encouraging diversion to transit by commuters, both those who work and live in the City. Major employers should be involved in this effort; the NAS should have priority as the City's largest employer.
   g. Experimentation and development of other inducements to transit use, such as fare discounts.
   h. Bus routes should be reevaluated for efficiency of timing and location.

2. The City should encourage the use of public transit in new developments. New residential, commercial and industrial developments should be designed to promote the use of buses.
   a. Compact development which can be easily served by mass transit should be encouraged.
   b. Bus turnouts and comfortable bus shelters should be provided in new areas with minimal impact on adjacent residences.

3. The City should encourage developers of new areas to study and undertake the use of private buses to minimize the traffic impact of their developments on the existing community. Mini-bus connections to BART could be considered, for example.

4. Bus lanes should be considered to allow buses to bypass waiting vehicles and provide a time saving for buses during periods of congestion.

Car Pools and Alternative Transportation Systems

1. The City should work with Caltrans, employers, new developers, and others to publicize and encourage car and van pooling.

2. The administrators of the Naval Air Station and College of Alameda should encourage the use of carpools and van pools among staff and students respectively as a means of reducing the use of private vehicles.

3. Broaden transportation alternatives by encouraging the use of vans and buses by large employers or groups of employers to provide vans or buses for employees. This system may connect with BART or AC Express buses, or relate to centers near employee residences.

4. Encourage use of private transit where public transit does not exist.

5. Develop a shuttle service to move shoppers between the three major shopping areas, i.e., Park Street, South Shore and Fernside.

Bicycle Circulation

1. The Bike Route Master Plan should be implemented. Bikeways recommended in this plan for new developments should be included in the Bike Route Master Plan.
   a. The Bicycle Route Master Plan should be revised to provide for a future off-street bike path along Doolittle Drive, and to avoid establishing on-street bikeways on streets with existing volumes of 15,000 or more.

2. On-street bikeways should be acceptable along most roads, though separate, off-street bikeways could be considered adjacent to streets which carry significant amounts of truck traffic.

3. Parking should be prohibited along new streets to on-street bikeways.

4. Bikeways should be large enough and designed to minimize conflicts between pedestrians and bicyclists and protect the safety and rights of pedestrians.

5. The City should continue its community education program to encourage bicycle use and safety. Information should be published on bicycle laws and safety, the rights of pedestrians, as well as bike route locations.

6. The City should develop and implement a program for maintaining and cleaning bikeways.

7. Bicycle parking and locking facilities should be improved and more provided.

a. Existing bicycle parking facilities should be improved where necessary to insure bicycle security.

b. Bike lockers or secure bike racks should be provided near public buildings, in parks, and around shopping and commercial areas. Secure, fenced bicycle storage areas should be provided at schools.

c. Bike parking should be without cost to the bicyclist. Financing sources such as bike license fees and parking ticket and meter revenues should be considered.

8. The City should work with Caltrans to add a bike path to the Bay Farm Island bridge that would be in addition to the existing pedestrian walkway. All possible outside funding sources should be investigated, with the assistance of MTC.

Railroads

1. The City should monitor the availability of railroad lines. Abandoned right-of-ways should be considered for use as bike and pedestrian paths or development of small passenger railroads or other circulation systems and/or buffering open space areas.

2. Encourage use of railroad lines to handle freight in place of trucks.

Motorized Vehicles

Motorcycles, Motor Scooters, Mopeds, etc.

1. A new ordinance should be developed which sets noise level limits for motorized vehicles operating within the city. The ordinance should contain enforcement measures.

a. Prohibit the sale of modified exhaust systems for street use.

b. Active enforcement with illegal motorists.

Pedestrians

1. Pedestrian access should be considered equal with vehicle access when reviewing development applications and public projects.

2. Pedestrian access should be provided and encouraged on all bridges.

a. Pedestrian access should be facilitated from the bridge to the sidewalk, particularly at the Miller-Sweeney bridge at Tilden Way.

3. Pedestrian access should be integrated into all parking lots, particularly at shopping centers, through the use of such methods as:

a. Pedestrian esplanades with landscaping and textured paving to connect shopping and business areas with on-street sidewalks.

b. Signs to delineate pedestrian crossings, particularly where pedestrian crossings intersect driveways.

4. Particular attention should be paid to providing for people with limited mobility, including the handicapped, the elderly and people with small children and strollers.

Energy Conservation Home Requirements and Agreement For Individual or Multi-Family Dwellings*

Manufacturer List of Energy Conserving Appliances and Devices

Gas Range (Pilotless Ignition)

Caloric
Gaffers & Sattler
Modern Maid
O'Keefe & Merritt
Tappan
Hardwick

Gas Dryers (Pilotless Ignition)

Norge
Hotpoint
General Electric
Wizard
Maytag
Speed Queen
Frigidaire
Whirlpool

Automatic Set-Back Thermostat

Robert Shaw
Honeywell
Intermatic (remote mounted)
Paragon (remote mounted)
Ammark
White-Rogers
General Time
Therm-O-Guard

Refrigerator

Wide Availability
Check AHAM booklet for KWH/Yr. usage

Dishwasher

Wide Availability

Caulking Materials

Coplanar (polycel one)
DAP

Laundry Dryer

General Electric
Hotpoint
Speed Queen
Westinghouse
Whirlpool
Sears
Wards

Water Heater

American
A.O. Smith
National
Hoyt
Rheem
Jetglas
Jackson

Clogged Filter Indicator

General Electric

Honeywell
Sherwood

Dimmer Lighting Control

General Electric
Leviton

Water Heating Insulating Blanket

Johns/Manville Owens/Corning

Water Flow Control/Shower Heads

Dole (2.5 GPM) Flow Control
Kohler
Noland
Speakman
Wrightway
Minuse
Omni
Nydel

Water Closets

American-Standard
Briggs
Eljier
Kohler
Sears
Microphor (Compressed Air)

Insulated Hot Water Wrap

Armstrong
Deflect-O
Sears
Eslon

Air Conditioning/Heat Pumps

Room — Check AHAM booklet for EER's
Central — Check ARI booklet for EER's
EER is determined by:

$$EER = \frac{BTUH}{WATTS}$$

*Source: Pacific Gas and Electric Company

Minimum Standards for Qualification for Premium Energy Conservation Home

I. General

The purpose of these requirements is to encourage the prudent and efficient use of energy in new residential construction.

II. Minimum Standards

A. To qualify for the Premium Energy Conservation Home Program, builders are required to incorporate in their new dwellings a variety of energy conserving devices and methods.

B. All gas and electric appliances incorporated in the living structure are to be approved and/or certified by the American Gas Association and/or the Underwriters Laboratories.

C. The structure will contain insulation, weatherstripping, and glazing that complies with local, state, or federal (FHA) specifications.

D. To qualify as Premium Energy Conservation Homes, dwelling units will be rated by a scoring system. The table of points which follow is based on the relative energy saving of various appliances and appurtenances, that will be installed in the qualifying single or multi-family dwelling unit.

E. Qualification procedure will be as follows:

(1) PG&E customer.

(2) Minimum number of points per qualifying unit will be:

Single Family Dwelling Units.................. 100 points
Multi Family Dwelling Units.....................90 points

(3) Point determination per energy conserving devices installed and method incorporated in the dwelling will be as follows:*

* Actual annual energy savings may be higher or lower depending on individual operation and locality.

Specific Area	Points Allowed	Score
(a) Insulation:		
Ceiling-R-30 (per 1000 sq. ft.)	2	________
Walls-R-19 (per 1000 sq. ft.)	3	________
Slab Floors w/moisture barrier & Carpet (per 1000 sq. ft.)	10	________
Conventional Floors-R-19 instead of R-11 or R-11 if none required by law (per 1000 sq. ft.)	17	________
Carpet in lieu of tile (per 1000 sq. ft.) (kitchen, entry, bath, etc.)	1	________
Double glazing when not required by code (per 25 sq. ft.window area)	3	________
Window treatments (per 100 sq. ft. area) (shades, awnings, reflective film, etc.)	1	________
Garage	5	________
(b) Major Appliances: (Builder installed)		
Microwave oven	13	________
Gas Range with pilotless ignition	8	________
Oven with light and window (gas or electric range)	1	________
Thermostatic top burner (gas or electric range)	2	________
Dishwasher with switch controllable drying cycle	5	________
Gas dryer with pilotless ignition	20	________
(c) Space Heating:		
Set-back thermostat	10	________
Clogged filter indicator	10	________
or if used with air conditioning	14	________
Individual Zone (Electric) Wall mounted thermostats - all zones	15	________

Heat Pump - Central Unit (Multi Family application - Wall units accepted.)		
Unit with cooling EER - more than 68	Unit, +30 additional points qualifies	
Solar Assisted Heating System Active and/or Passive Points will be allocated based on estimated energy savings when supported by satisfactory documentation.		

(d) Water Heating:

Conventional with insulation blanket	7	________
Conservation model	10	________
Conservation model with insulation blanket	15	________
Solar Assisted Hot Water System Points will be allocated based on estimated energy savings when supported by satisfactory documentation.		

(e) Air Conditioning:

Central or room units EER: EER = 7 is base		
8	10	________
9	18	________
10 or more	24	________
(Points for above may only be allowed in area requiring air conditioning.)		

(f) Lighting:

Fluorescent Application		
Kitchen area	4	________
Laundry area	1	________
Bathrooms (all)	5	________
Bathrooms (full only)	3	________
Recreation room	1	________
Shop or garage	1	________
Dimmer Lighting Controls Minimum of 3 controls per dwelling	1	________

(g) Plumbing:

Heating unit no farther than 15' from point of maximum use (kitchen sink)	7	________
Insulated hot water piping (through all unheated areas)	7	________
Fixtures, All		
Shower heads with flow control devices rated at 3 GPM or less)	14	________
Toilets, 3 1/2 gallon flush models	5	________
Toilets, 2 1/2 gallon flush models	9	________

(h) Chimney: (Fireplace)

Positive damper, without gas outlet	4	________
Fireplace with heat exchanger or free-standing models	6	________
TOTAL SCORE		

F. To calculate the estimated annual energy savings attributable to device indicated, multiply the assigned point value by 3 therms if the device is associated with a gas application or 30 kwh if associated with an electrical application. One point is also given for each 2,000 gallons/year water savings.

Example: Gas range with pilotless ignition — 8 points
8 points x 3 therms = 24 therms annual savings

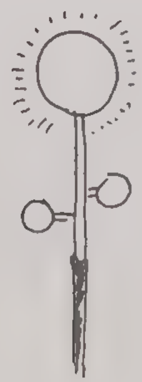
G. A builder may desire to incorporate other energy conserving features in lieu of those listed. If so, the approximate annual savings should at least equal the qualifying total for his particular unit. Check paragraph F above when making conserving calculations. Figures are subject to PG&E verification and approval.

Types of Lighting Compared

	Type and Wattage	Lumens Per Watt (L/W)	Lifetime	Lumen Efficiency	Equipment Cost	Operating Cost	Color Characteristics	Recommended Uses	Remarks
incandescent	Standard 15 25 40 60 75 100 250 500	 8 9 12 14 18 18 20 21	750-1000 hrs: shortest all lamps	80% prior to failure	Low	High	• Nearest to natural daylight Skin tones heightened. Gives "warm" atmosphere where used	• Where lamps are burned fewer than 6 hrs. a day • Where foot-candle requirements are under 50. • Where "warm" atmosphere is desired.	• Efficiency is critically dependent on operating voltage. Do not burn lamps at voltage lower than the output of the electrical socket.
	Long-life 100		2.3 or 5 years		High	High		• Only where maintenance is difficult or irregular	
	PAR 250	18.4		Reduced to 70% after 1,000 hrs.				• As narrowbeam floodlights • "Cool beam" lamps suitable for displaying flood	
	Tungsten Halogen 45 100 150 200 250 spot 500 flood 1,000 flood	 13 18 18 19 13 14 17	4,000 hrs. minimum for high-voltage lamps	90% after 3,000 hrs.	Low	Low	• Good color rendition; bright, white	• Where strong light is desired • Where good color is desired General lighting for large rooms, production areas • In cornices and niches	• Low wattages available for single-purpose lamps • Not as flexible as standard incandescent • Significant savings in energy and costs over standard incandescent
	PAR 150			98% after 3,000 hrs.				• For floodlighting and outdoor decorative lighting	
fluorescent	40 60 75 110	66 68 73 72	20,000 hrs.	70% at 12,000-15,000 hrs.	Higher than incandescent	Lower than incandescent	• Warm white has the poorest color rendition, cool and deluxe warm white • Deluxe cool white, are better: Deluxe cool white most closely approximates natural daylight	• In production areas, kitchens, offices • As display lighting deluxe warm, and white can be usually used in place of incandescent bulbs	• Ballasts required for start-up reduce lamp efficiency • Color-corrected lamps are 30% less efficient than standard • Efficiency especially affected by ambient temperature • Cool and warm white have highest outputs, followed by deluxe and color-correcting lamps

high-intensity discharge

Type and Wattage	Lumens Per Watt (L/W)	Lifetime	Lumen Efficiency	Equipment Cost	Operating Cost	Color Characteristics	Recommended Uses	Remarks
Mercury 40 100 175 250 400	 29 41 42 46 51	24,000 hrs.	75% after 16,000 hrs.	Low	Medium	• Available in clear, white, color-corrected, and deluxe white. Deluxe white has best color rendition • Deluxe white is interchangeable with cool white fluorescent	• Indoors to light large spaces such as kitchen and production areas • Outdoors in parking areas and as merchandising or decorative lighting	• Cannot be dimmed: voltage requirements are precise • Not as sensitive to frequent start-ups as fluorescent
Special Mercury 40 75 100	 18 36 36	24,000 hrs.	75% after 16,000 hrs.	Low	Medium	Excellent color, preferred alternative to cool white fluorescent • Second best color choice for "warm" atmosphere	• Can replace incandescent lamps in interior fixtures	• Limited number of sizes: strictly for interior fixtures • Higher wattages and longer life than standard mercury
Metal Halide 175 250 400	 70 64 80	7,500-15,000 hrs.	60% after 11,000 hrs.	Medium	Medium	• Better color than mercury; not as good as special mercury • Color-coated bulb has good, warm color; clear bulb less satisfactory • Best color rendition for outdoor lighting	• Parking areas • Large work spaces • Interior spaces lighted from above • Food displays	• Ballast required • Higher lumen output, lower lifetime than mercury
High-pressure Sodium 150 250 400	 89 80 106	 12,000 hrs. 15,000 hrs. 20,000 hrs.	80% at end of lifetime	High	Low	• Poor color rendition: grays colors of red and blue objects. Similar to warm white fluorescent	• Outdoor, where color is unimportant: in parking spaces and security uses • If illumination of building is enhanced by yellow light	• The most efficient lamp currently on the market



NOTES: Neon lights have not been included because they are commonly used only as decorative lighting.
Fluorescent lamps described are all "rapid start."
Lumen efficiencies and numbers of lumens per watt are approximations.

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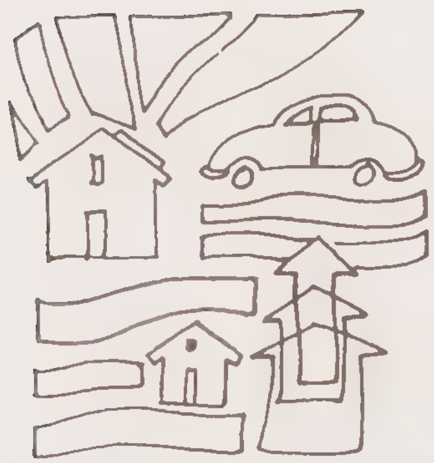

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